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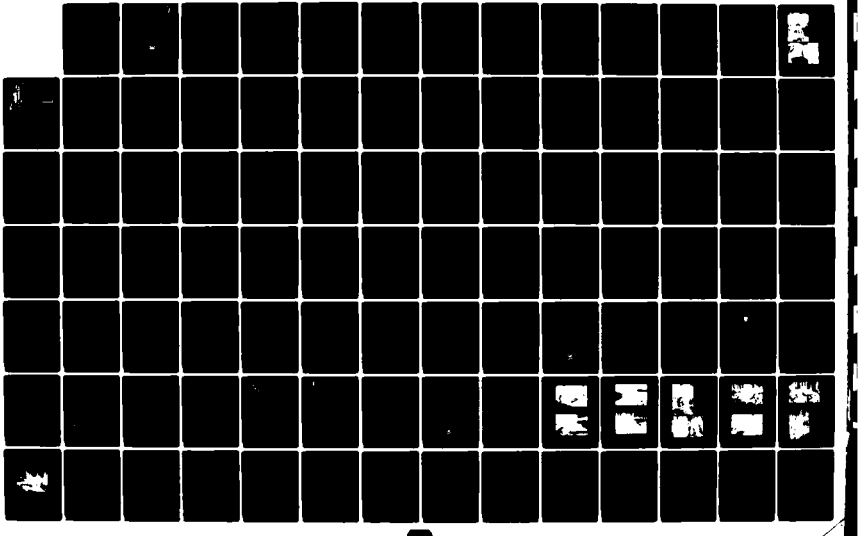

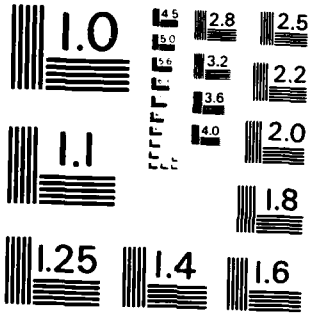

HOUSATONIC RIVER BASIN

STOCKBRIDGE, MASSACHUSETTS

STOCKBRIDGE BOWL DAM
MA 00022

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGAM

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS. 02154

APRIL 1981

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Housatonic River Basin

Stockbridge, Massachusetts

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Stockbridge Bowl Dam is an earth embankment dam with a concrete and stone masonry spillway. The dam is approximately 340 feet long, with a maximum height of 19 ft. The spillway has a length of 28 feet. Based on the visual inspection, the overall condition of the project is judged to be poor. Because the dam has an intermediate size and high hazard potential classification, the test flood is the PMF.

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DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

NEDED

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts

Dear Governor King:

Inclosed is a copy of the Stockbridge Bowl Dam (MA-00022) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Stockbridge Bowl Dam would likely be exceeded by floods greater than 4 percent of the Probable Maximum Flood (PMF). Our screening criteria specifies that a dam classified as high hazard with a spillway capacity insufficient to discharge fifty percent of the PMF be judged as having a seriously inadequate spillway. As a result this dam is assessed as unsafe, non-emergency until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as it would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

We recommend that within twelve months from the date of this report the owner of the dam engage the services of a qualified registered engineer to determine further the potential of overtopping the dam and the need for and the means to increase project discharge capacity. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed and round-the-clock surveillance should be provided during periods of heavy precipitation or high project discharge.

NEDED
Honorable Edward J. King

I approve the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the program.

Copies of this report have been forwarded to the Department of Environmental Quality Engineering and to the owner, Town of Stockbridge, Stockbridge, MA. Copies will be available to the public in thirty days.

I wish to thank you and the Department of Environmental Quality Engineering for your cooperation in this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Commander and Division Engineer

STOCKBRIDGE BOWL DAM

MA 00022

HOUSATONIC RIVER BASIN
STOCKBRIDGE, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	MA 00022
Name of Dam:	STOCKBRIDGE BOWL DAM
Town:	STOCKBRIDGE
County and State:	BERKSHIRE, MASSACHUSETTS
Stream:	LARRYWAUG BROOK
Date of Inspection:	25 NOVEMBER 1980

BRIEF ASSESSMENT

Stockbridge Bowl Dam is an earth embankment dam with a concrete and stone masonry spillway. The dam is approximately 340 feet long, with a maximum height of 19 feet. The spillway has a length of 28 feet. The spillway crest is 3 feet below the top of dam. There is a 350-foot long dike, with a maximum height of 18 feet, to the south of the main dam. The dike forms an approach channel to an outlet structure containing a sluice gate and a 5'-6" diameter outlet conduit.

Stockbridge Bowl (also known as Lake Mahkeenac) is a recreational water body. It is presently being used as an emergency water supply for the Town of Lenox.

The dam was originally constructed between 1880 to 1885. The dam raises water above the level of a natural "great pond".

Based on the visual inspection, the overall condition of the project is judged to be poor. Visual observations made during the course of the inspection revealed deficiencies which require attention and should be corrected before further deterioration leads to a hazardous condition.

Because the dam has an intermediate size and high hazard potential classification, the test flood is the Probable Maximum Flood (PMF). The test flood inflow for Stockbridge Bowl, having a drainage area of 11.2 square miles, was estimated to be 17,920 cfs. Effects of reservoir storage would reduce the test flood inflow to an outflow of approximately 14,000 cfs which would overtop the dam by about 3.6 feet. Spillway capacity at the top of dam is 470 cfs which is less than 4% of the routed test flood outflow.

A number of recommendations are given in Section 7.2 for implementation by the owner. The owner should retain a qualified Registered Professional Engineer immediately upon receipt of this report to investigate and design repairs to the outlet structure at the southwest end of the dike. The other recommendations should be implemented within 12 months of receipt of this Phase I Inspection Report.

The other recommendations in general are as follows:

Retain a qualified Registered Professional Engineer to:

- Perform a detailed hydrologic and hydraulic analysis to determine the need for and methods to increase project discharge capacity.

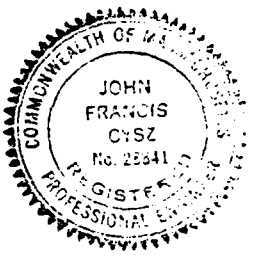
- Design procedures for and supervise removal of trees and debris from the dam and dike.

- Design methods to prevent erosion on the upstream slopes of the dam and dike.

- Investigate and establish a monitoring program for seepage through the face and along the walls of the spillway, misalignments in the wingwalls downstream of the spillway, and wet areas along the toes of both the dam and dike.

In addition, the owner should also implement the recommended remedial program in Section 7.3 including the control of burrowing animal population, repair of eroded areas, brush removal, reduction of slope trespass, establishment of a formal written operation and maintenance program, and a formal written program for surveillance and downstream warning.

A qualified Registered Professional Engineer should also be engaged to make a comprehensive technical inspection of the dam and dike once a year.



John F. Cysz
Project Manager
MA P.E. No. 28841

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

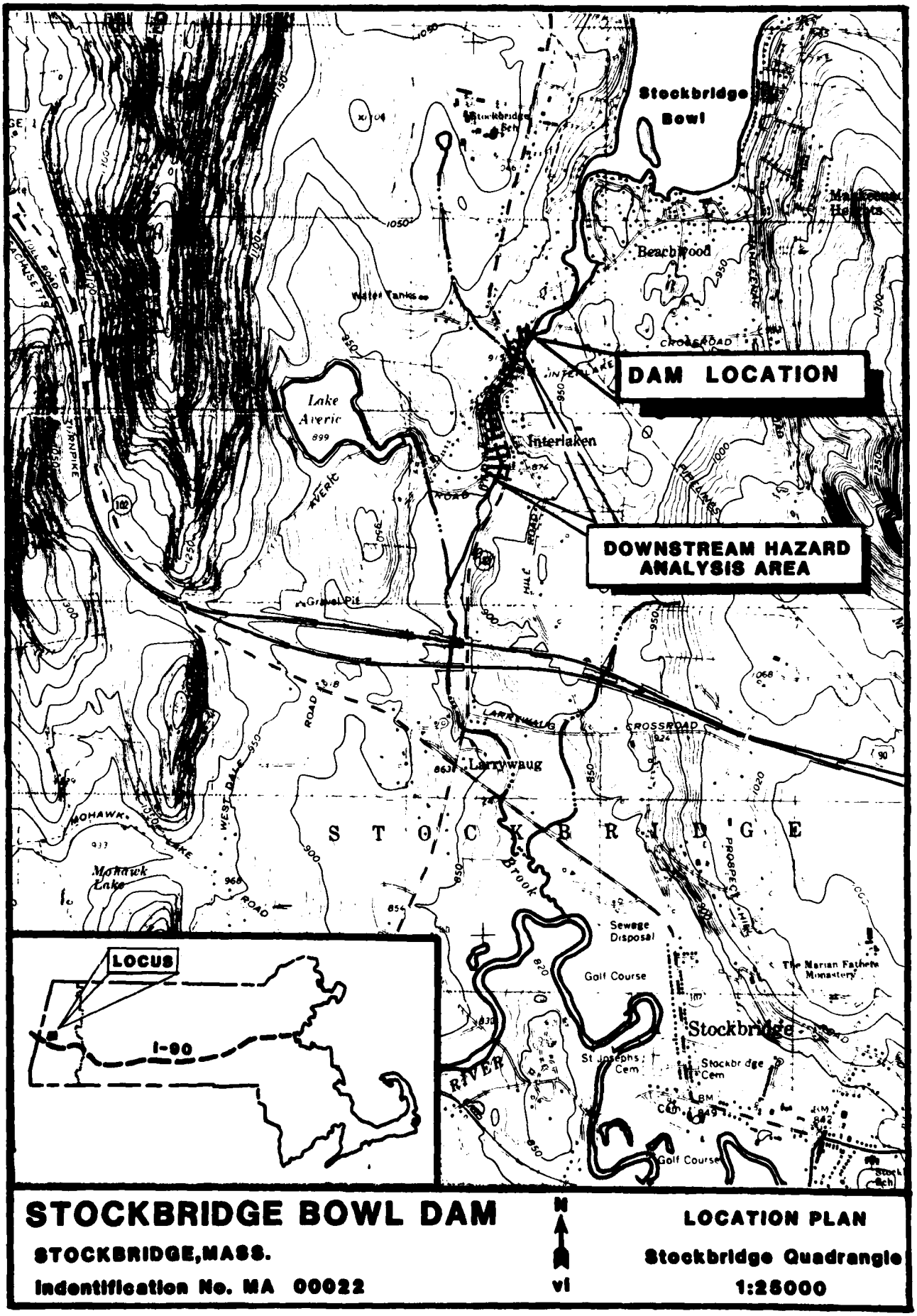
Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

TABLE OF CONTENTS

Stockbridge Bowl Dam
looking upstream.

Looking downstream. Spillway is in right foreground; outlet conduit is at end of channel. Note ditch running southerly parallel to toe of dike.

OVERVIEWS OF STOCKBRIDGE BOWL DAM



STOCKBRIDGE BOWL DAM

STOCKBRIDGE, MASS.

Indentification No. MA 00022

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vi

LOCATION PLAN

Stockbridge Quadrangle

1:25000

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
STOCKBRIDGE BOWL DAM
SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising Inspection of Dams within the New England region. Robert G. Brown & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the Commonwealth of Massachusetts and State of Vermont. Authorization and notice to proceed were issued to Robert G. Brown & Associates, Inc. under a letter of 23 October 1980 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract Number DACW33-81-C-0004 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT

a. Location

Stockbridge Bowl Dam is located in the Town of Stockbridge, Massachusetts. The dam is on Larrywaug Brook (also known as Marsh Brook) approximately 2.2 miles upstream from the brook's confluence with the Housatonic River. The dam impounds Stockbridge Bowl, which is also known as Lake Mahkeenac. The lake is used primarily for recreational purposes, but is also currently being used as an emergency water supply for the Town of Lenox. Stockbridge Bowl Dam is shown on the USGS Stockbridge, Massachusetts quadrangle at latitude 42° 19.2' and longitude 73° 19.8'. Access to the damsite is from Interlaken Crossroad.

b. Description of Dam and Appurtenances

(1) Main Dam and Spillway - Stockbridge Bowl Dam is an earth embankment dam with a concrete and stone masonry spillway. The dam has a maximum height of 19 feet.

There is a 160-foot long embankment northeasterly of the spillway. The embankment has a top width of 5 feet at the easterly abutment and a width of 10 feet where it joins the spillway. The upstream and downstream faces of the northeasterly embankment have slopes of about 2H:1V.

The overflow spillway has a 5½-foot wide concrete crest, 28 feet in length (measured between the concrete spillway walls at each end of the spillway (see Photograph 2, Appendix C). The spillway crest is oriented in a general northeasterly direction. The spillway discharges directly to Larrywaug Brook. There are 1½-inch diameter drains in the concrete spillway walls (2 on the east wall and 3 on the west wall). The spillway has a stone and concrete bottom approach channel which extends about 20 feet upstream of the concrete crest. There is a concrete sill (possibly remains of old fish screen) at the upstream end of the approach channel (see Photographs 2 and 3, Appendix C). Below the concrete crest the spillway is constructed of dry laid stone masonry (see Photograph 1, Appendix C). There is a grouted stone discharge apron which extends 11 feet downstream of the face of the spillway. There are two 4-inch drains beneath this discharge apron.

The spillway has dry laid stone masonry wingwalls which have a flare angle of about 45° downstream of the crest. The rock units making up the stone masonry are 2 to 3-foot size.

There is a wood footbridge with 2 trolley rail stringers over the spillway. The ends of the stringers are on concrete pedestals 1 foot above the top of the concrete spillway walls (see Photograph 2, Appendix C).

There is a 150-foot long embankment to the south of the spillway. The top width of the southerly embankment is approximately 10 feet. The downstream face has a side slope of 2H to 1V. The upstream face has a slope of about 1.5H to 1V.

(2) Dike and Regulating Outlet - There is a dike which forms a channel leading southwesterly to the regulating outlet. This dike has a top width of 10 feet and a crest length of about 350 feet. The dike is oriented in a general northeast/southwest direction. The dike intersects the southerly embankment of the main dam at an angle of approximately 150°. The dike has a maximum height of 18 feet at its southwesterly end. The downstream face of the dike has a general slope of 2H to 1V. The upstream face has a general slope of 1½H to 1V. The channel formed by the dike is about 30 feet wide.

A regulating outlet is located at the southwest end of the dike. The outlet conduit is 5'-6" in diameter, about 40' long, and is made of riveted steel plate.

There is a concrete outlet structure with a steel grate at the upstream end of the 5'-6" conduit (see Photograph 7, Appendix C). The concrete structure contains a 6-foot by 6-foot sluice gate. The sluice gate appears to have wooden guide slots. There is a floor stand-mounted gate operator (Rodney Hunt, Type 3004) at the top of the concrete outlet structure. At the time of inspection the sluice gate was submerged and the construction of the gate proper could not be determined. (1930 repair plans are included in Appendix B.)

The 5'-6" outlet conduit butts up to the concrete outlet structure containing the gate. There is a concrete endwall and dry laid stone retaining wall at the downstream end of the steel conduit (see Photograph 9, Appendix C). The discharge from the conduit free falls about 5 feet vertically onto a concrete paved discharge apron. The discharge channel extends through a wooded area before joining Larrywaug Brook about 350 feet downstream of the regulating outlet.

At about the mid-point in the crest of the dike there is a fill area which extends about 40 feet downstream of the dike. This fill area appears to be a plug for an old breach in the dike. There is a 6 to 8-foot deep gully downstream of this fill area (see General Plan, Appendix B). There is a 10-foot wide ditch in the woods about 100 feet downstream of the dike (see Photographs 5 and 8, Appendix C). This ditch runs roughly parallel with the dike and may have been an old sluice way. There is an earth berm on the downhill side of the ditch. The ditch intersects the 6 to 8-foot deep gully noted above.

c. Size Classification

The dam has a maximum hydraulic height of 19 feet and a top of dam storage of 11,000 acre-feet. According to Corps of Engineers criteria (storage between 1000 and 50,000 acre-feet and height between 40 and 100 feet) set forth in Recommended Guidelines for Safety Inspection of Dams, the dam is classified as intermediate size based on storage.

d. Hazard Classification

The dam is in a high hazard category because a major breach of the dam could cause appreciable damage to roads, bridges, and utilities in the downstream area. Loss of more than a few lives would be possible.

The Village of Interlaken lies approximately .5 miles downstream of the damsite (see Section 5.5).

e. Ownership

The dam was previously owned by the heirs of William H. Forbes, according to Land Court records. The dam is currently owned by the Town of Stockbridge, under the management of its Board of Selectmen, Town Hall, West Main Street, Stockbridge, MA 01262, Telephone (413) 298-4714.

The property was conveyed to the town in 1928 under Transfer Certificate of Title No. 1012, Land Court records. Restrictions in the deed stipulate that the land is to be used and maintained for recreational purposes, in addition to regulating the water level in the lake.

f. Operator

Day-to-day operation of the dam is assigned to:

Charles E. Tenney, Superintendent
Sewer and Water Department
Town of Stockbridge
Town Hall
West Main Street
Stockbridge, MA 01262
Tel.: (413) 298-4717 (Town Offices)
(413) 298-5581 (Pump Station)
(413) 298-3459 (Home)

g. Purpose of Dam

The dam impounds Stockbridge Bowl above the level of a natural impoundment. The original "great pond" elevation has been established by the Land Court and Division of Waterways as being 96.78 (Land Court decree datum) or 3.2 feet below the spillway crest.

The lake is used primarily for recreational purposes. It is also presently being used as an emergency water supply for the Town of Lenox. Deed restrictions in the town's deed stipulate that the land around the dam is to be used and maintained for recreational purposes. The deed would allow the dam to be used for generation of water power so long as this did not draw down the water level.

h. Design and Construction History

The original Stockbridge Bowl Dam was built between 1880 to 1885 to provide water power to the Barker Grist Mill which used to be located several hundred feet downstream. The dam has been known as the Barker Dam and the Newton Dam in the past. No records or plans of the original design or construction were found. An old dam called the Old Reservoir Dam was located about 600 feet upstream. Its remains were removed about 1930.

In 1918, the Berkshire County Commissioners engaged Great Barrington, MA engineer J.W. Curtiss to inspect and report on the condition of the Stockbridge Bowl Dam. He noted numerous deficiencies and recommended immediate measures to lower the water level two feet by removing the plank and timber spillway and raising the low points in the dike. This work was completed in October, 1918. In 1920, Mr. Curtiss made a further report, recommending additional improvements so the water level could be restored to its previous level. It is unclear when this work was performed.

In October 1928, ownership of the dam was transferred to the Town of Stockbridge. In May 1930, the town was granted License No. 1160 by the Massachusetts Department of Public Works to repair the spillway, to extend the draw-off pipe and improve the embankment at the end of the canal and to remove the Old Reservoir Dam. (Copies of the License and five sheets of plans for this work

are included in Appendix B.) This work was inspected by engineer Harry W. Heaphy and approved by the County Commissioners in December 1930. Additional work was also completed on the splash aprons at the foot of the spillway and outlet works. The spillway walls were increased to 3 feet wide at the base and 2 feet wide at the top. The spillway crest elevation was checked and confirmed to be 100.00, and two bench marks were established and filed at the County Engineers office.

In September 1937, further repairs were designed for the town by engineer Harry W. Heaphy. The work consisted of laying a new grouted riprap splash apron 10 feet wide below the spillway. A 2' wide toe wall was specified, with four 4" diameter weep holes spaced at 10' on center through the toe wall.

The December 31, 1948 flood caused some damage to the dam. There was a washout of the embankment northerly of the spillway and also along the dike. The state, under a flood relief program, repaired the washouts and raised the low sections in the dike during April of 1949. The trash rack at the outlet works which had been bent was repaired and replaced. County Engineer also recommended that the privately owned fish screen at the head of the spillway be removed since this tended to clog, contributing to the flood damage; replace the riprap in the spillway approach channel which was damaged by the flood; repair the splash apron at the outlet works at the end of the canal and repair or replace the stone masonry retaining wall which was bulging badly; and remove the wooden catwalk over the spillway. It is unclear how much of the recommended work was actually completed by the state. A 1950 letter recommended some additional work on the trash rack.

In 1961, the catwalk over the spillway was replaced. Only minor repairs have been performed in recent years. These have included repairs to the trash rack, replacing riprap on the dam near the north spillway wall, and repairing the catwalk.

i. Normal Operation Procedures

According to the superintendent of the Sewer and Water Department, the dam is visited on the average of once a week by either himself or his assistant. The Sewer and Water Department was assigned responsibility for operating the dam by the Selectmen beginning on January 1, 1973. Prior to that time, the Selectmen engaged a caretaker who lived adjacent to the dam.

Normal operation procedures consist of adjusting the sluice gate at the end of the canal to maintain a constant and safe water level. The water level is generally several inches below the spillway crest. The gate is reportedly opened in anticipation of storms to allow for the increased inflow. The gate is normally operated within a range of ¼ to ½ open. It has not been opened more than halfway since the department has operated the gate. The gate reportedly cannot be closed tightly. The gate operator is not lubricated or exercised.

The sluice gate is operated by a floor stand-mounted gate operator with a removable crank handle and key nut. The handle is kept in the department vehicle. There is no lock on the operator. There are no rising stems or gages on the operator. Adjustment of the sluice gate is accomplished by the experience of the personnel and "eyeballing" the outflow.

The trash rack is checked during each visit and raked. During the fall and late winter, the rack is raked daily. The spillway is also checked during the visit and debris is removed when necessary.

Minor routine maintenance is performed either by the Water Department or by the Highway Department. The need for more significant repairs is reported to the Board of Selectmen for action. Trees which fall across the canal are removed two or three times a year according to the Acting Superintendent of the Highway Department. No maintenance of the embankment is performed.

Neither the Sewer and Water Department nor the Highway Department have any files, records or plans on the dam or maintenance work performed on it. There is no formal established operation and maintenance plan. No downstream warning plan exists. However, the operator's vehicle is equipped with two-way radio in contact with the Town Hall, Police Department and Highway Department.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area consists of 11.2 square miles of lightly developed wooded, rolling and mountainous terrain. Approximately 65 percent of the watershed lies in the Town of Stockbridge and about 30 percent lies in the Town of Lenox. Small portions of the drainage area lie in the Towns of Lee and Richmond. The drainage area has length of 4.5 miles and an average width of about 2.5 miles. Its long axis is in a north/south direction. The watershed is drained by several small streams which enter around the lake. The largest brook is Lily Brook which enters on the east. Elevations in the watershed range from 1853 NGVD on Lenox Mountain to 925 NGVD at Stockbridge Bowl.

b. Discharge at Damsite

Discharge at the damsite is over the 28' long concrete spillway and through one 5'-6" diameter outlet which is controlled with a sluice gate. There are no present provisions for flashboards on the spillway. The normal pool elevation is assumed to be 925.0 NGVD as shown on the USGS Stockbridge Quadrangle. (The Land Court decree datum used on the 1930 License plans set the normal pool elevation at 100.0.)

(1) Outlet Works - 5'-6" diameter, riveted ½" Boiler Plate, invert of outlet 915; controlled by sluice gate; capacity if fully opened, 360 cfs with water at 928 NGVD. (Assumed plugged by debris during test flood - assumed capacity 30 cfs.)

(2) Maximum Flood at Damsite - unknown. Dam and dike reportedly overwashed during storm of December 31, 1948.

(3) Ungated Spillway Capacity at Top of Dam - 470 cfs at 928.0 NGVD.

(4) Ungated Spillway Capacity at Test Flood Elevation - 1500 cfs at 931.6 NGVD.

(5) Gated Spillway Capacity at Normal Pool Elevation - not applicable.

(6) Gated Spillway Capacity at Test Flood Elevation - not applicable.

(7) Total Spillway Capacity at Test Flood Elevation - 1500 cfs at 931.6 NGVD.

(8) Total Project Discharge at Top of Dam - 500 cfs at 928.0 NGVD.

(9) Total Project Discharge at Test Flood Elevation - 14,000 cfs at 931.6 NGVD.

c. Elevation (feet above NGVD)

(1) Streambed at Toe of Dam - 909 NGVD.

(2) Bottom of Cutoff - unknown.

(3) Maximum Tailwater - unknown.

(4) Normal Pool - 925.0 NGVD according to USGS Quadrangle.

(5) Full Flood Control Pool - not applicable.

(6) Spillway Crest - 925.0 NGVD.

(7) Design Surcharge (Original Design) - unknown.

(8) Top of Dam - 928.0 NGVD, lowest; (930.0 NGVD highest).

(9) Test Flood Surcharge - 931.6 NGVD.

d. Reservoir (length in feet)

(1) Normal Pool - 9500.

(2) Flood Control Pool - not applicable.

(3) Spillway Crest Pool - 9500.

(4) Top of Dam - 9600.

(5) Test Flood Pool - 9700.

e. Storage (acre-feet)

(1) Normal Pool - 10,000 (of which about 7500 is natural impoundment).

(2) Flood Control Pool - not applicable.

(3) Spillway Crest Pool - 10,000.

(4) Top of Dam - 11,000.

(5) Test Flood Pool - 13,000.

f. Reservoir Surface (acres)

(1) Normal Pool - 372.

(2) Flood Control Pool - not applicable.

(3) Spillway Crest - 372.

(4) Top of Dam - 420.

(5) Test Flood Pool - 480.

g. Dam

(1) Type - earth embankment.

(2) Length - 340 feet.

(3) Height - 19 feet.

(4) Top Width - varies 5 to 10 feet.

(5) Side Slopes - upstream 1½H:1V, downstream 2H:1V.

(6) Zoning - unknown.

(7) Impervious Core - unknown.

(8) Cutoff - unknown.

(9) Grout Curtain - unknown.

h. Dike

(1) Type - earth embankment.

(2) Length - 350 feet.

(3) Height - 18 feet.

(4) Top Width - 10 feet.

(5) Side Slopes - upstream 1½H:1V, downstream 2H:1V.

(6) Zoning - unknown.

(7) Impervious Core - unknown.

(8) Cutoff - unknown.

(9) Grout Curtain - unknown.

(10) Other - concrete bulkhead at outlet works.

i. Diversion and Regulating Tunnel (not applicable)

j. Spillway

(1) Type - concrete overflow weir over old stone masonry.

(2) Length of Weir - 28.3 feet.

(3) Crest Elevation - 925.0 NGVD.

(4) Gates - none.

(5) U/S Channel - Pond at end of 2500' long inlet, 25' long spillway walls, 20' long stone and concrete bottom approach.

(6) D/S Channel - Larrywaug Brook.

k. Regulating Outlets

(1) Invert - 915 NGVD (outlet).

(2) Size - 5'-6" diameter, 40' long.

(3) Description - Riveted ¼" boiler plate.

(4) Control Mechanism - Floor stand mounted gate operator with removable crank (Rodney Hunt, Type 3004), controlling a 6' x 6' x 3" thick oak sluice gate in wooden guide slots.

(5) Other - approach channel, 30' wide, 350' long, ends at concrete bulkhead for outlet works; trash rack 6'-6" wide, 12' high, made from 3/8" x 1½" bars spaced 2" on center (1-3/4" clear opening).

SECTION 2
ENGINEERING DATA

2.1 DESIGN DATA

No design data for the original construction or for any subsequent repairs were available. Plans and/or specifications for some repairs in 1930 and 1937 are on file with the County Engineering Department.

2.2 CONSTRUCTION DATA

No construction records for the original construction were available. The County Engineers have some file data, correspondence and inspection reports.

2.3 OPERATION DATA

No written records of operation and maintenance were available except from County Engineers files. Operation procedures described in this report are derived from interviews of operating personnel.

2.4 EVALUATION OF DATA

a. Availability

The files of the County Engineering Department include correspondence, plans of repairs and inspection reports from 1918 to 1969. Plans and DPW Chapter 91 License for 1930 repairs are filed in the Berkshire Middle District Registry of Deeds, Land Court Document No. 3059. The Town of Stockbridge has little data regarding the dam. The Massachusetts Department of Public Works District One office has inspection reports from 1972 to 1978.

b. Adequacy

The lack of in-depth engineering data did not allow a definitive review. Therefore, the condition of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based on the visual inspection, the dam's past performance, and sound engineering judgment.

c. Validity

No engineering data for the original construction were available to validate. Based on the visual inspection, it appears that the repair work described in the available file data was completed except where otherwise noted.

SECTION 3
VISUAL INSPECTION

3.1 FINDINGS

a. General

Stockbridge Bowl Dam was inspected on November 25, 1980. At the time of inspection the water level behind the dam was 26 inches below the spillway crest. A sketch showing the general layout of the dam with inspection notes, is included in Appendix B. Photographs showing project features and conditions are included in Appendix C.

b. Main Dam and Dike

(1) Crest - The crest elevation of the embankment northeasterly of the spillway varies within about 1 foot. There is a footpath along the full crest length of this embankment (see Photograph 2, Appendix C).

The crest elevation of the embankment southerly of the spillway varies within about 2 feet. There is a footpath along the full length of the southerly embankment crest (see Photograph 3, Appendix C).

The crest elevation of the dike varies within about 1 foot. There is a footpath along the entire length of the dike (see Photographs 4 and 6, Appendix C).

The footpaths on the embankment crest have no vegetative cover. The footpath on the southerly embankment is worn/eroded to a depth of about 6 inches (see Photograph 3, Appendix C).

(2) Upstream Slope - The upstream slope of the northeasterly embankment has large trees, some of which are leaning towards the lake (see Photograph 2, Appendix C). There is a large tree which has been uprooted and has fallen into the lake near the northeasterly abutment. The uprooting has left in 1-foot deep depression over about a 3-foot diameter area. Undercutting of the embankment is noticeable at the normal water level. This undercutting is most pronounced within the middle third of the northeasterly embankment. There is erosion at the point where the upstream slope joins the northeast spillway wall. This erosion appears to be associated with loss of soil from behind the short section of stacked rock wall (3-foot size) adjacent to the northeast spillway wall.

The upstream slope of the southerly embankment shows undercutting of about 1½ feet at the normal pool level. This undercutting is most pronounced where the southerly embankment meets the upstream end of the southwest spillway wall (see Photograph 3, Appendix C). There is no riprap on the upstream slope of the southerly embankment. There are trees and brush on the entire upstream slope of the southerly embankment. There is erosion on the upstream slope at the point where the southerly embankment joins the dike.

There are trees growing from the upstream slope of the dike (see Photograph 6, Appendix C). There is an erosion bench about 1-foot deep on the upstream slope at the normal water level. There is no riprap on the upstream slope of either the dam or dike except for two 15 to 20-foot long sections on each side of the concrete outlet structure at the southwesterly end of the dike (see Photograph 7, Appendix C). There is evidence of slumping of this riprap. There is erosion on the upstream slope adjacent to the concrete outlet structure.

(3) Downstream Slope - The downstream slope of the northeasterly embankment is wooded. There is a 1-foot deep footpath showing signs of erosion 30' to the northeast of the spillway. There is tree and brush growth immediately behind and at the end of the northeasterly stone masonry wingwall downstream of the spillway.

The downstream slope of the southerly embankment is wooded. There are several areas on the downstream slope which are devoid of vegetation or forest litter and which show evidence of sheet erosion and small gullies. There are small mounds (6 inches) which may be related to fallen trees, and slope trespass. Bending at the bases of trees is an indication of possible downslope movement in the embankment. Animal burrows are present in the downstream face of the southerly embankment. The downstream toe of the southerly embankment is generally damp. The elevated root systems of the trees indicate a high water table. There is a wet area (about 25 feet in diameter) about 20 feet beyond the downstream toe at the point where the southerly embankment joins the dike. There is standing water in the ditch (see Photograph 5, Appendix C) which starts at the southerly embankment and runs roughly parallel to the downstream toe of the dike. There was no evidence of movement of materials from the embankments. Trees are growing immediately behind the southwesterly stone masonry wingwall downstream of the spillway. There is a 3-foot diameter depression in the embankment slope immediately behind this wingwall. This depression may be related to a tree which was uprooted in the past.

The downstream slope of the dike is wooded. There is a debris dump covering the downstream slope at the southwest end of the dike. This debris may have come from the trash racks at the regulating outlet (see Photograph 8, Appendix C). There is standing water in the ditch downhill from the toe of the dike (see Photograph 8, Appendix C). Some of this water is surface drainage off the downstream slope of the dike.

c. Appurtenant Structures

(1) Spillway - The concrete spillway crest rests upon an ungrouted stone masonry wall (see Photograph 1, Appendix C). The concrete crest has no major cracking or

misalignments. The stone masonry visible on the downstream face of the spillway has good alignment, both horizontal and vertical. There are cut steel pins in the concrete crest which appear to have been flashboard supports.

The tops of the concrete walls at the ends of the spillway are 3 feet above the spillway crest. There is spalling of the concrete, cracks and efflorescence, but no exposed reinforcing steel.

Erosion of the embankments is occurring at the upstream ends of the concrete spillway wall (see Photograph 3, Appendix C). The northeast spillway wall has a section of stacked rock wall at its upstream end. There is evidence of soil loss from behind and between the rock units.

The 1½-inch diameter drains in the concrete spillway walls can be probed to a depth of between 6 inches and 16 inches. There was no flow from any of the drains. The bottom of the spillway approach channel appears satisfactory. The purpose of the concrete sill at the upstream end of the approach channel could not be confirmed. It may have been part of an old fish screen. The depth of the sill is not known.

The downstream wingwall at the southwest end of the spillway has seepage at the intersection with the spillway. The stones are covered with green moss. There are trees growing behind and at the end of the west wingwall. This wingwall also has a noticeable bulge in it. There are trees and brush growing behind and at the end of the north downstream wingwall. The grouted stone apron at the downstream toe of the spillway is in good condition with no evidence of cracking or undermining. The left 4-inch drain (looking downstream) is partially submerged and the right 4-inch drain had no flow at the time of inspection.

(2) Regulating Outlet - At the time of inspection the sluice gate was not seated and water was flowing over the gate and discharging through the 5'-6" steel conduit. The concrete outlet structure has deep spalling and efflorescence along horizontal cracks (see Photograph 7, Appendix C). There are two upstream projections at each end of the trash rack which are broken and spalled. The floor stand for the sluice gate is rusted. The wooden guide seats for the sluice gate are badly decayed. The sluice gate inside the gate chamber could not be observed during this inspection. The 5'-6" steel conduit butts up to the concrete outlet structure. The top of the steel conduit is deformed about 3 inches where it meets the concrete gate chamber. The concrete endwall at the downstream end of the 5'-6" conduit is resting on a dry laid stone masonry retaining wall. The retaining wall beneath the concrete endwall is battered

so that water discharging from the conduit flows over it (see Photograph 9, Appendix C). The section of stone retaining wall to the south of the outlet conduit is bulged and appears unstable. There are trees growing adjacent to the concrete endwall and stone masonry retaining wall. Some of the trees are sharply bent at their bases which could indicate embankment creep.

d. Reservoir Area

The dam impounds Stockbridge Bowl (also known as Lake Mahkeenac) which is primarily a recreational water body having a normal surface area of 372 acres. The lake is presently being used as an emergency water supply for the Town of Lenox. The lake has its long axis in a north/south direction. A part of the lake is a natural pond which has been raised by the dam. There are a number of homes along the shoreline, many of which are seasonal dwellings. The dam is located about 2500 feet south of the main body of the lake. Flow from the lake travels to the dam in a natural channel about 100 feet wide at its shallow point (see Location Map). There is a gas pipeline which crosses this channel in an embankment about 600 feet north of the dam (see Overview Photograph). The crest of this embankment appears to be about 3 feet lower than the spillway crest. At present the lake can only be lowered to the level of the pipe embankment.

e. Downstream Channel

The spillway discharges directly to Larrywaug Brook. The channel downstream of the spillway is generally gravel and cobble bottom with small boulders. The channel passes through a wooded area and flows southerly, roughly parallel to Route 183. The channel from the regulating outlet joins Larrywaug Brook about 800 feet downstream of the spillway. There are areas along the brook where there is undercutting of the banks and leaning trees; however, there are no major constrictions until the brook crosses under Interlaken Crossroad about 900' downstream of the spillway.

3.2 EVALUATION

Based on the visual inspection, the overall condition of the project is judged to be poor. The condition of the dike is poorer than that of the dam. Visual observations made during the course of the inspection revealed deficiencies which require attention and should be corrected before further deterioration leads to a hazardous condition.

With respect to the main dam, the following are areas of specific concern:

The growth of large trees on the embankment are a threat to the dam because they weaken the embankment. Uprooting of large trees could lead to a breach in the dam and could cause blockage of the spillway.

Trees growing behind the downstream wingwalls for the spillway could be part of the cause of wall misalignments.

The erosion and undercutting on the upstream slope causes undesirable loss of embankment material. This condition is serious adjacent to the upstream ends of the spillway walls. Unvegetated areas including footpaths increase the potential for embankment erosion.

Animal burrows weaken the embankment and can also lead to erosion.

There is evidence of seepage through the face of the spillway, particularly at the southwest end. This requires monitoring and further study to determine if seepage is a stable condition.

The bulging of the southwesterly downstream wingwall does not presently appear to seriously affect the stability of the dry laid stone masonry. This condition requires monitoring to determine if movements in the wall are continuing.

The wet area near the downstream toe of the southerly embankment should be investigated to determine if it is a result of embankment seepage.

With respect to the dike, the following are areas of specific concern:

The growth of large trees on the embankment are a threat to the dike.

The erosion and undercutting on the upstream slope causes undesirable loss of embankment material.

The apparent slumping of the riprap just upstream of the concrete outlet structure requires monitoring and further study to determine if there is embankment slippage at this point.

The debris dump on the downstream slope of the embankment, at the southwest end of the dike, obscures inspection of the embankment and observation of possible seepage.

The sluice gate is not properly seated and repairs are required to make the gate fully operable.

The interior of the gate chamber and the 5'-6" conduit should be inspected carefully under no-flow conditions.

The stone masonry retaining wall, which supports the concrete endwall at the end of the 5'-6" conduit, appears unstable, particularly on the south side of the conduit. Failure of this retaining wall could lead to dislocations in the outlet conduit and collapse of the embankment.

A complete listing of Recommendations and Remedial Measures are given in Section 7.

SECTION 4
OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES

a. General

Operational procedures for the project are not formally established but are based on the experience of the operating personnel.

The dam is visited on the average of once a week. During the fall and late winter, the dam is visited daily. The trash rack at the outlet conduit is checked and raked during each visit since debris tends to accumulate and clog the rack. The spillway is also checked.

Flow through the outlet conduit is regulated by means of the sluice gate. The flow is adjusted to attempt to maintain a constant and safe water level without allowing water to flow over the spillway.

b. Description of any Warning System in Effect

There is no written surveillance or warning system in effect. Operating personnel visit the dam before and during periods of high runoff. Vehicles are equipped with two-way radios which could be used for contacting the Police or Highway Departments.

4.2 MAINTENANCE PROCEDURES

a. General

There are no formal maintenance procedures for the project. Minor routine maintenance is performed by the operating personnel or the Highway Department. In the past, this has been limited to removing fallen trees from the canal, and repairing the trash rack and catwalk. No records of routine maintenance are maintained.

b. Operating Facilities

No maintenance of the operating facilities is normally performed other than periodic repairs to the trash rack. The sluice gate and operating mechanism have not been lubricated or exercised since before 1973.

Additional maintenance and repairs to the dam and operating facilities have been recommended in previous County and State Inspection reports.

4.3 EVALUATION

A formal written operational and maintenance plan, including an annual comprehensive technical inspection by a qualified Registered Professional Engineer, should be developed to insure that problems that are encountered can be remedied within a reasonable period of time. A formal written surveillance and downstream warning (emergency preparedness) plan should be established for this structure.

Responsibility and authority for the project should be formally established and assigned to one department to insure continuity.

SECTION 5
EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL

The drainage area consists of 11.2 square miles of lightly developed wooded, rolling and mountainous terrain. Approximately 65 percent of the watershed lies in the Town of Stockbridge and about 30 percent lies in the Town of Lenox. Small portions of the drainage area lie in the Towns of Lee and Richmond. The drainage area has length of 4.5 miles and an average width of about 2.5 miles. Its long axis is in a north/south direction. The watershed is drained by several small streams which enter around the lake. The largest brook is Lily Brook which enters on the east. Elevations in the watershed range from 1853 NGVD on Lenox Mountain to 925 NGVD at Stockbridge Bowl.

5.2 DESIGN DATA

No hydraulic or hydrologic design data or criteria were available.

5.3 EXPERIENCE DATA

The dam and dike were damaged by flooding in 1948. Reportedly there was a washout around an end of the spillway and also a washout around the outlet structure at the southwest end of the dike.

There is evidence of a possible old breach in the dike about 250 feet from the outlet structure. No records are maintained for discharges at the damsite.

5.4 TEST FLOOD ANALYSIS

Stockbridge Bowl Dam is classified as intermediate size having a hydraulic height of 19 feet and a top of dam storage of 11,000 acre-feet. The dam was determined to have a high hazard classification. Using the Recommended Guidelines for Safety Inspection of Dams, the test flood is the Probable Maximum Flood (PMF).

The Probable Maximum Flood was estimated using methods contained in "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Inspections" issued by the New England Division Corps of Engineers. The curve for rolling terrain was used in this estimate.

The PMF test flood inflow from the 11.2 square mile drainage area was estimated to be 17,920 cfs (1600 CSM). Storage effects would reduce the test flood inflow to a routed test flood outflow of approximately 14,000 cfs.

During test flood conditions water would rise to elevation 931.6 which is about 3.6 feet above the top of dam. Water would be passing through the spillway at a depth of 6.6 feet and at a flow rate of 1535 cfs. Spillway capacity at the top of dam (928.0 NGVD) is 470 cfs which is less than 4 percent of the routed test flood outflow.

The ½ PMF was also estimated and it was found that during this event water would rise to elevation 930.1 which is 2.1 feet higher than the top of dam. The ½ PMF routed outflow at the damsite is estimated to be 6800 cfs.

In both analyses the pool level at the start of the reservoir routing was assumed to be 925 NGVD.

Based on the observed condition of the outlet structure, the 5'-6" conduit was assumed in these analyses to be closed but not seated. The discharge capacity of this 5'-6" conduit, fully open, is estimated to be 360 cfs which is only 3 percent of the routed PMF outflow and has a negligible effect on the rise of the test flood. Overtopping could cause erosion which could lead to a breach of the dam.

5.5 DAM FAILURE ANALYSIS

The impact of failure of the dam was assessed using Corps of Engineers "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs". The estimate assumes:

a. the reservoir surface is at the top of the dam at the time of the breach, and

b. a breach of 40% of the dam length at mid-height occurs (88 feet).

The estimated initial discharge resulting from the breach would be approximately 12250 cfs. The flow from the breach would probably diminish as the pool immediately behind the dam drained and as the hydraulic control changed to the channel upstream of the dam.

The first impact point would be at Interlaken Crossroad, about 900 feet downstream of the dam. At this location, Larrywaug Brook is contained in a stone arch culvert (presently being reconstructed). The breach flow would cause water to flow over the road at a depth of up to 7 feet. Two historic buildings which have floor levels at or below the road at this location would be damaged or destroyed and loss of life would be possible. Antecedent flows would be approximately 10 feet below the road level.

Approximately 2500 feet downstream, Larrywaug Brook passes through the Village of Interlaken. Water from the breach would flow over Averic Road at a depth of up to 5 feet. Three structures which have floor levels near the road level could be damaged or destroyed by impact or flooding. Bridges and utilities would be damaged and loss of life would be possible. Antecedent flows would be about 1 foot below the road level.

Further downstream an additional two to four structures could be flooded before the breach flow entered the Housatonic River floodplain about 2 miles downstream of the damsite.

Because of the potential for a large amount of property damage and the possible loss of more than a few lives, Stockbridge Bowl Dam was classified as High Hazard.

SECTION 6
EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS

The most significant visual observations regarding structural stability are the following:

(1) Growth of large trees on both the upstream and downstream slopes are a threat because of the potential for uprooting which could lead to a breach in the embankment.

(2) The wet areas at the toes of the southerly embankment and dike may be due to embankment seepage and should be monitored.

(3) There is evidence of instability of the downstream stone retaining wall at the end of the outlet conduit particularly on the south side of the conduit. The stone retaining wall supports the downstream end of the 5'-6" outlet conduit. Failure of this wall could lead to a breach in the dike at this location.

(4) There is erosion on the upstream slopes of all embankments and in areas of footpaths along the crests and across the downstream slope of the northeasterly embankment of the main dam.

(5) The bulge in the southwest wingwall downstream of the spillway and the depressed area behind this wall could be evidence of movements which may be related to seepage. Failure of the wingwalls could lead to a breach in the dam at the spillway.

(6) The entire outlet conduit and control mechanism is in poor condition which may cause difficulty in an emergency situation.

6.2 DESIGN AND CONSTRUCTION DATA

No design or construction records for the original construction were available. Reports, correspondence and plans of repairs between 1918 and 1950 are filed in the office of the County Engineering Department. Plans and License No. 1160 for the 1930 repairs are filed in the Berkshire Middle District Registry of Deeds in Land Court Document No. 3059.

6.3 POST-CONSTRUCTION CHANGES

Between 1918 and 1920, changes were made to the spillway, and low points along the dike were filled. In 1930, a concrete spillway floor was poured over the old stone masonry and new concrete spillway walls were constructed. The outlet conduit was extended about 20 feet, a new bulkhead, sluice gate and control mechanism and trash rack were constructed, and the embankment was extended 20' downstream. (The Old Reservoir Dam 600' upstream was also removed.)

Repairs to the spillway were made in 1937. After the December 31, 1948 flood which overwashed the dam and dike, repairs were made to the embankments, the spillway and the outlet works (see Section 1.2h.).

6.4 SEISMIC STABILITY

The dam is located in Seismic Zone No. 2 and in accordance with recommended Phase I guidelines, does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition

The Phase I visual inspection of Stockbridge Bowl Dam indicates that the overall condition of the project is judged to be poor. The condition of the dike is poorer than that of the dam. Visual observations made during the course of the inspection revealed deficiencies which require attention and should be corrected before further deterioration leads to hazardous conditions.

b. Adequacy of Information

The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Urgency

The owner should retain a qualified Registered Professional Engineer immediately upon receipt of this report to investigate and design repairs to the outlet structure at the southwest end of the dike.

The other recommendations and remedial measures described in Paragraphs 7.2 and 7.3 should be implemented by the owner within 12 months after receipt of this Phase I Inspection Report.

7.2 RECOMMENDATIONS

The owner should retain a qualified Registered Professional Engineer to:

(1) Investigate and design repairs or replacement for the outlet structure at the southwest end of the dike. The stability of embankments adjacent to the existing outlet structure and the stone retaining wall at the downstream end of the 5'-6" conduit should be investigated. The interior of the gate chamber and conduit should be inspected during no flow conditions. This should be done immediately upon receipt of this report.

(2) Perform a detailed hydrologic and hydraulic analysis to determine the need and methods to increase project discharge capacity at the damsite.

(3) Design procedures for, and supervise removal of trees and debris from the dam and dike, including the replacement with appropriate materials, in a manner which will not compromise the stability of the embankment. This should be done for at least 25 feet downstream of the embankment toes. Upon removal of the trees, the embankments should be graded, and grass

or other erosion resistant surface constructed. The embankment crests should be graded to a uniform elevation.

(4) Design methods to prevent erosion on the upstream slopes of the dam and dike.

(5) Investigate and establish a monitoring program for possible continuing movements in the downstream wingwalls for the spillway. The stability of the embankments adjacent to the wingwalls should be included in the investigation.

(6) Investigate and establish monitoring program for the wet area at the toe of the southerly embankment and dike. If necessary, a method to control seepage should be designed. The area of seepage through the face of the spillway should also be investigated and monitored.

(7) Design repairs to cracked and spalled concrete spillway walls.

(8) Design a method of controlling the debris which accumulates in the outlet works approach channel and at the outlet works.

The owner should carry out all the recommendations made by the engineer. All work should be done under supervision of the engineer.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures

The owner should implement the following remedial measures:

(1) Control the population of burrowing animals on the downstream face of the embankment and dike and fill in all existing burrows.

(2) Repair various erosion areas on the embankment and dike crests and downstream faces.

(3) Repair the eroded areas behind the principal spillway wingwalls.

(4) Institute measures to reduce trespass on the embankments and dike.

(5) Establish a formal written program for operation and maintenance including monitoring of seepage, control of woody vegetation on the embankments, and periodic lubrication and exercising of the gate mechanisms.

(6) Develop a formal written program for warning downstream residents in case of emergency (emergency preparedness program).

(7) Engage a qualified Registered Professional Engineer to make a comprehensive technical inspection once a year.

7.4 ALTERNATIVES

There are no practical alternatives to the above recommendations.

APPENDIX A

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

DAM: Stockbridge Bowl Dam MA 00022 (includes dike to the southwest of main dam)

DATE: 25 November 1980

TIME: 1:00 p.m.

WEATHER: Cloudy, drizzle

W.S. ELEV. 922.8 U.S. 909 DN.S.

ELEV. DATUM: Pool elev. taken from USGS Quadrangle

INSPECTION PARTY:

1. J. F. Cysz, P.E. (Hydrology/Hydraulics)
2. J. E. Walsh, P.E. (Baystate Environmental Consultants, Inc.)(Geotechnical)
3. K. N. Hendrickson, P.E. (12/3/80)(Structural)
4. _____
5. _____
6. _____

OTHERS PRESENT DURING INSPECTION:

1. _____
2. _____
3. _____
4. _____

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
DAM EMBANKMENT	Note: Elevation of normal pool taken from USGS Quadrangle - 925 NGVD.
Crest Elevation	928 NGVD adjacent to spillway.
Current Pool Elevation	922.8 NGVD.
Maximum Impoundment to Date	Not known. (Washouts in 1948)
Surface Cracks	None observed - embankment covered with leaves and forest litter.
Pavement Condition	No pavement.
Movement or Settlement of Crest	Crest elevation varies within range of about 2± feet. Footpath on crest of southerly embankment is worn/eroded to a depth of 6".
Lateral Movement	None observed.
Vertical Alignment	Erosion scars on upstream face.
Horizontal Alignment	Horizontal alignment irregular by design. (See Appendix B.)
Condition of Abutment and at Concrete Structures	Voids/settlement behind spillway walls.
Indications of Movement of Structural Items on Slopes	Bulge in southwesterly downstream wingwall for spillway.
Trespassing on Slopes	Footpaths on crest and on downstream slope causing erosion.
Vegetation on Slopes	Forested - large trees and brush on both upstream and downstream slopes.
Sloughing or Erosion of Slopes or Abutments	Wave bench (1½' undercut) on unprotected upstream slope, trees undermining and falling. Bending of trees on downstream slope could indicate slope movement.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
DAM EMBANKMENT (cont'd.)	
Rock Slope Protection - Riprap Failures	There is no riprap along upstream slope of dam embankment. Failure of riprap at end of spillway training walls (erosion behind 3' size stacked rock units at upstream end of northeasterly spillway wall).
Unusual Movement or Cracking at or near Toes	None observed. However, there is a heavy forest leaf mat.
Unusual Embankment or Downstream Seepage	Standing water in ditch near downstream toe of southerly embankment.
Piping or Boils	None observed.
Foundation Drainage Features	Two 4-inch diameter pipes under spillway apron. Left pipe partially submerged. Right pipe - no flow.
Toe Drains	None observed.
Instrumentation System	None.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
DAM EMBANKMENT (cont'd.)	
Rock Slope Protection - Riprap Failures	There is no riprap along upstream slope of dam embankment. Failure of riprap at end of spillway training walls (erosion behind 3' size stacked rock units at upstream end of northeasterly spillway wall).
Unusual Movement or Cracking at or near Toes	None observed. However, there is a heavy forest leaf mat.
Unusual Embankment or Downstream Seepage	Standing water in ditch near downstream toe of southerly embankment.
Piping or Boils	None observed.
Foundation Drainage Features	Two 4-inch diameter pipes under spillway apron. Left pipe partially submerged. Right pipe - no flow.
Toe Drains	None observed.
Instrumentation System	None.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
DIKE - SOUTHWEST OF MAIN DAM	
Crest Elevation	928 NGVD.
Current Pool Elevation	922.8 NGVD.
Maximum Impoundment to Date	Unknown.
Surface Cracks	None observed. Heavy forest leaf mat and dump obscures inspection.
Pavement Condition	No pavement.
Movement or Settlement of Crest	Crest elevation varies within about 1/2 foot.
Lateral Movement	Warping of embankment towards downstream, possibly an old breach repair.
Vertical Alignment	Crest elevation varies within about 1/2 foot.
Horizontal Alignment	Generally straight except for warping as noted above, and erosion scars on upstream slope.
Condition at Abutment and at Concrete Structures	Settlement and voids around concrete headwalls at inlet and outlet.
Indications of Movement of Structural Items on Slopes	Yes - large bulge of stone masonry retaining wall to left of conduit outlet (cracking of rock units noted).
Trespassing on Slopes	Footpaths, dump
Vegetation on Slopes	Yes - forested.
Sloughing or Erosion of Slopes or Abutments	Undercutting of embankment on upstream slope. Evidence of slope creep left of outlet headwall.
Rock Slope Protection - Riprap Failures	No rock slope protection for embankment. Slumping of riprap near upstream end of outlet structure. Erosion behind concrete headwall.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
DIKE - SOUTHWEST OF MAIN DAM (cont'd.)	
Unusual Movement or Cracking at or near Toes	Bulge in stone masonry retaining wall below and to left of conduit outlet.
Unusual Embankment or Downstream Seepage	Standing water in ditch near toe. (Could be surface drainage.)
Piping or Boils	None observed. Forest leaf mat and dump obscure inspection.
Foundation Drainage Features	None observed.
Toe Drains	None.
Instrumentation System	None.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	See previous sheet describing dike.
Bottom Conditions	Not visible.
Rock Slides or Falls	Undercutting of embankment and trees on both sides of channel.
Log Boom	None. (Two trees fallen across channel 4' above normal water.)
Debris	Minor.
Condition of Concrete Lining	No concrete lining.
Drains or Weep Holes	None.
b. Intake Structure	
Condition of Concrete	Severe spalling, separation of construction joint for concrete gate chamber.
Stop Logs and Slots	No stoplogs, steel trash rack with 1-3/4" bar separation. Trash rack is rusted.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	There is no control tower. Sluice gate operator positioned on top of concrete gate chamber. Top of gate chamber corresponds to top of dike for outlet works approach channel.
a. Concrete and Structural	
General Condition	Poor.
Condition of Joints	Open construction joint.
Spalling	Yes - deep.
Visible Reinforcing	None observed.
Rusting or Staining of Concrete	Yes.
Any Seepage or Efflorescence	Badly spalled concrete.
Joint Alignment	Open construction joint upstream face of gate concrete headwall for gate chamber.
Unusual Seepage or Leaks in Gate Chamber	Yes - 6' sluice gate closed but not seated, decayed timber gate slots (est. 25 cfs) - leakage.
Cracks	Yes - small
Rusting or Corrosion of Steel	Yes, trashrack and rising stem for sluice gate.
b. Mechanical and Electrical	
Air Vents	None.
Float Wells	None.
Crane Hoist	None.
Elevator	None.
Hydraulic System	None.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER (cont'd.)	
Service Gates	6'± square sluice gate in timber slots, rising stem type, seating head in concrete gate chamber - Rodney Hunt Type 3004, Shop No. 431. No handwheel or key on operator - no evidence of recent maintenance. General condition, poor.
Emergency Gates	None.
Lightning Protection System	None.
Emergency Power System	None.
Wiring and Lighting System in Gate Chamber	None.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Poor - see description of gate chamber on previous page.
Rust or Staining on Concrete	Yes, near steel conduit.
Spalling	None observed from outlet.
Erosion or Cavitation	None observed from outlet. Internal inspection of conduit not possible due to flow from leaking gate.
Cracking	None observed from outlet.
Alignment of Monoliths	Not applicable.
Alignment of Joints	Not applicable. Conduit has riveted joints.
Number of Monoliths	Not applicable.

NOTE: 5'-6" steel plate conduit with butt joint against concrete gate chamber conduit deformed at upstream end where it meets concrete gate chamber.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition	Poor - concrete headwall at end of 5'-6" conduit. Headwall rests on stone masonry retaining wall. Trees growing immediately behind concrete headwall.
Rust or Staining	Around steel conduit.
Spalling	Yes.
Erosion or Cavitation	No evidence of cavitation.
Visible Reinforcing	None observed.
Any Seepage or Efflorescence	None observed but evidence of previous seepage through stone retaining wall to left of concrete headwall.
Condition of Joints	Voids at junction between downstream concrete endwall and stone masonry retaining wall.
Drain Holes	None - voids in stone masonry retaining wall.
Channel	
Loose Rock or Trees Overhanging Channel	Yes.
Condition of Discharge Channel	OK.

NOTE: Discharge from conduit impinges on stone masonry retaining wall below outlet headwall.

NOTE: Concrete apron at end of conduit is cracked on left; shows 5" downward displacement.

NOTE: Slope to left of outlet headwall shows evidence of movement i.e. bulge in stone masonry retaining wall and cracked rock units.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	Approach channel is pond. Rock bottom approach channel within limits of spillway (see photographs).
General Condition	OK.
Loose Rock Overhanging Channel	No.
Trees Overhanging Channel	Yes.
Floor of Approach Channel	OK.
b. Weir and Training Walls	
General Condition of Concrete	Appear stable.
Rust or Staining	Minor.
Spalling	Yes - 1/2" - 3/4" deep in concrete spillway walls.
Any Visible Reinforcing	None observed.
Any Seepage or Efflorescence	Yes - efflorescence from tight cracks in concrete spillway walls, but water below spillway during inspection. Minor seepage at left wingwall in area of green moss.
Drain Holes	Yes - 3 in westerly wall, 2 in easterly spillway wall. 1¼" diameter holes.
c. Discharge Channel	
General Condition	OK. Grouted stone masonry apron 11' d/s of spillway is in good condition. No apparent undermining. D/S channel 2:1 slope on right; flat area to left.
Loose Rock Overhanging Channel	No.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS (cont'd.)	
Trees Overhanging Channel	Yes.
Floor of Channel	Natural, boulders, cobbles, forest debris.
Other Obstructions	None.

NOTE: Cutoff steel flashboard pins no longer useable.

Spillway discharges to Larrywaug Brook.

VISUAL INSPECTION CHECKLIST

DAM: Stockbridge Bowl Dam MA 00022 DATE: November 25, 1980

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	There is a 40" wide plank footbridge, 3½' wide, with 2 trolley track rail stringers with wood nailer (rotted) bolted to spillway walls. Bridge deflects (springy) under load;steel cable rails suspended from concrete guardrail posts embedded in embankment behind spillway walls.
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B

ENGINEERING DATA

LIST OF AVAILABLE DESIGN,

CONSTRUCTION AND MAINTENANCE RECORDS

A. PLANS AND SPECIFICATIONS:

(1) No plans or specifications for the original construction were found.

(2) Land Court Plans 7576A & B dated December 1918 and June 1920, filed with Original Certificate of Title No. 490 in the Berkshire Middle District Registry of Deeds, includes layout of dam, property lines and elevations.

(3) License No. 1160 dated May 27, 1930 issued to the Town of Stockbridge by Massachusetts Department of Public Works for repairs to spillway and dams, filed in Berkshire Middle District Land Court Document No. 3059 - 3 pages and 5 sheets of plans, copies attached.

(4) Plans, specifications and Bid Documents for Repairs to Splash Apron of the Spillway, dated 1937, filed in the County of Berkshire Engineering Department, Pittsfield, MA.

B. DESIGN RECORDS:

None found for original construction or for post-construction changes.

C. CONSTRUCTION RECORDS:

None found for original construction. Some correspondence relative to repairs from 1918 to 1950 is on file with the County of Berkshire Engineering Department.

D. MAINTENANCE:

Some correspondence as noted above.

PREVIOUS INSPECTION REPORTS

A. Inspections of dams were performed by the Massachusetts Department of Public Works, District 1, between 1971 and 1978 and reports are on file at District 1 Headquarters Pittsfield-Lenox Road, Lenox, MA - Latest Report and 1972 Description of Dam are attached.

B. Earlier inspections of dams were performed by the Berkshire County Engineer for the County Commissioners, and reports are filed at the County Engineer's office, County Court House, Pittsfield, MA - Latest Report is attached.

L-168

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: ~~City~~/Town STOCKBRIDGE Dam No. 1-2-283-4

Name of Dam Stockbridge Bowl Inspected by RDJordan - RSpaniol

Date of Inspection 8-22-78

Previous Inspection 9.23.76

2. Owner/s per: Assessors _____
Reg.of Deeds _____ Personal Contact _____

1. Town of Stockbridge Stockbridge
Name St. & No. City/Town/State Tel. No.

2. _____
Name St. & No. City/Town /State Tel No.

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

_____
Name St.& No. City/Town /State Tel.No.

4. No. of Pictures taken 1

5. Degree of Hazard: (If dam should fail completely)*

1. Minor _____ 2 Moderate _____

3. Severe x 4. Disastrous _____

*This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual X

Operative X Yes _____ No _____

Comments: _____

_____

7. Upstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs X

3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

_____

_____

L-168-A

DAM NO. 1-2-283-4

8. Downstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs X

3. Major Repairs _____ 4. Urgent Repairs _____

9. Emergency Spillway

Condition: 1. Good X 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

Comments: _____

_____

10. Water level at time of inspection 0.2 above X below _____

top of dam _____

principal spillway X

other _____

11. Summary of Deficiencies Noted:

X Growth (Trees & Brush) on Embankment _____

_____ Animal Burrows and Washouts _____

_____ Damage to slopes or top of dam _____

_____ Cracked or damaged masonry _____

X Evidence of seepage _____

_____ Evidence of piping _____

_____ Erosion _____

_____ Leaks _____

_____ Trash and/or debris impeding flow _____

_____ Clogged or blocked spillway _____

_____ Other _____

12. Remarks & Recommendations; (Fully Explain)

This structure is in the same condition as reported in 1976. Both slopes have a heavy growth of brush and trees, and the embankments ~~has~~ have been penetrated in several areas with extensive root systems.
The drawdown appears to be in working conditbn and the concrete and stone masonry spillway is in good condition. The seepage areas previously reported have not increased in size.

For location see Topo Sheet 2-D.

13. Overall Condition:

X 1. Safe

X 2. Minor repairs needed

_____ 3. Conditionally safe - major repairs needed

_____ 4. Unsafe

_____ 5. Reservoir impoundment no longer esists (explain)

Recommend removal from inspection list

L-169

DESCRIPTION OF DAM

DISTRICT ONE .

Submitted by R.D. Jordan Dam No. 1-2-283-4

Date 11-21-72 . City/Town Stockbridge

Name of Dam Stockbridge Bowl

---

1. Location: Topo Sheet No. 2-D .

Provide 8-1/2" x 11" in clear copy of topo map with location of Dam clearly indicated.

---

2. Year built: _____ . Year/s of subsequent repairs 1969

---

3. Purpose of Dam: Water Supply _____ . Recreational X .

Irrigation _____ . Other _____ .

---

4. Drainage Area: 10.3 sq. mi. _____ acres.

---

5. Normal Ponding Area: 372 Acres; Avc. Depth _____ .

Impoundment: _____ gals; _____ acre ft.

---

6. No. and type of dwellings located adjacent to pond or reservoir _____

i.e. summer homes etc. _____

---

7. Dimensions of Dam: Length _____ . Max. Height _____ .

Slopes: Upstream Face _____ .

Downstream Face _____ .

Width across top _____ .

---

8. Classification of Dam by Material:

Earth X . Conc. Masonry _____ . Stone Masonry _____ .

Timber _____ . Rockfill _____ . Other _____ .

---

9. A. Description of present land usage downstream of dam: _____

35 %rural; 15 % urban.

B. Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure

Yes Partial . No _____ .

L-169 A

DAM NO. 1-2-283-4.

10.

Risk to life and property in event of complete failure. Could cause serious damage to Town of Interlaken and Mass. Turnpike.

No. of people_____.

No. of Homes_____.

No. of Businesses_____.

No. of Industries_____. Type_____.

No. of Utilities_____. Type_____.

Railroads_____.

Other dams_____.

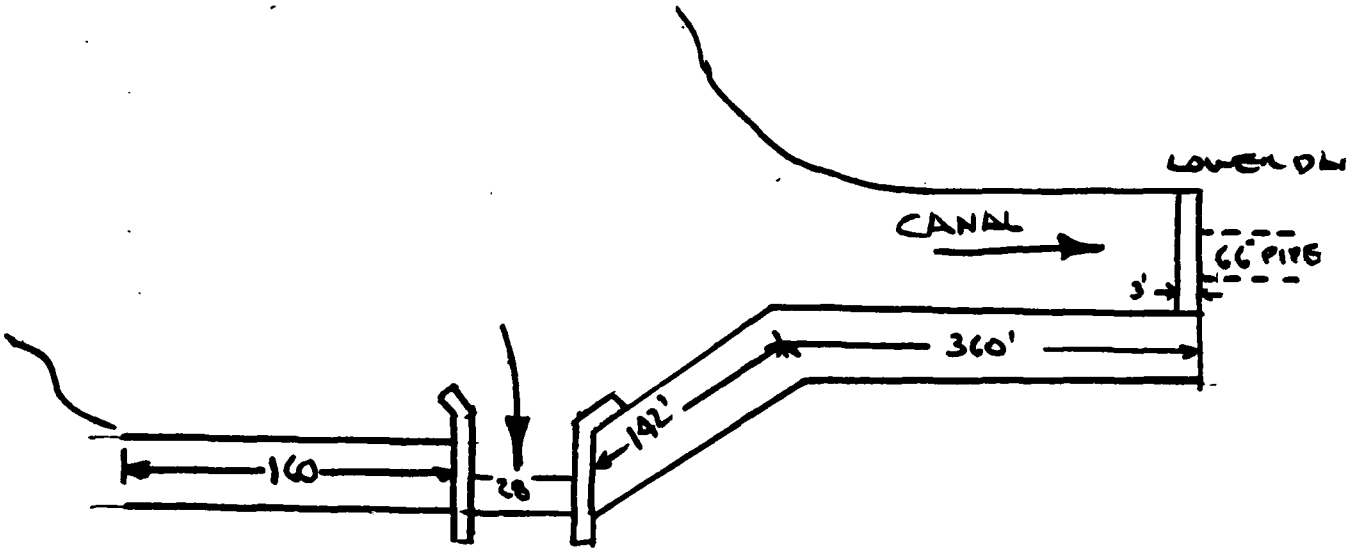
Other_____.

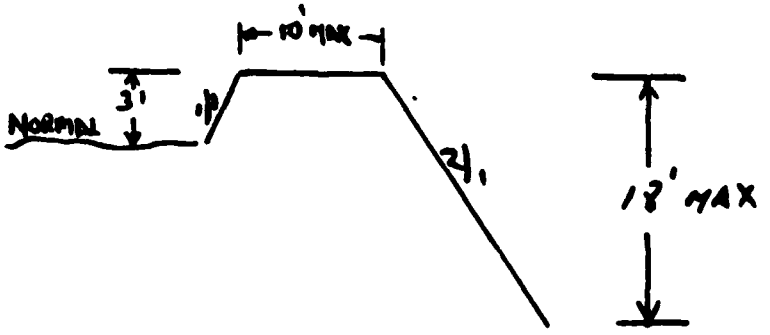
11.

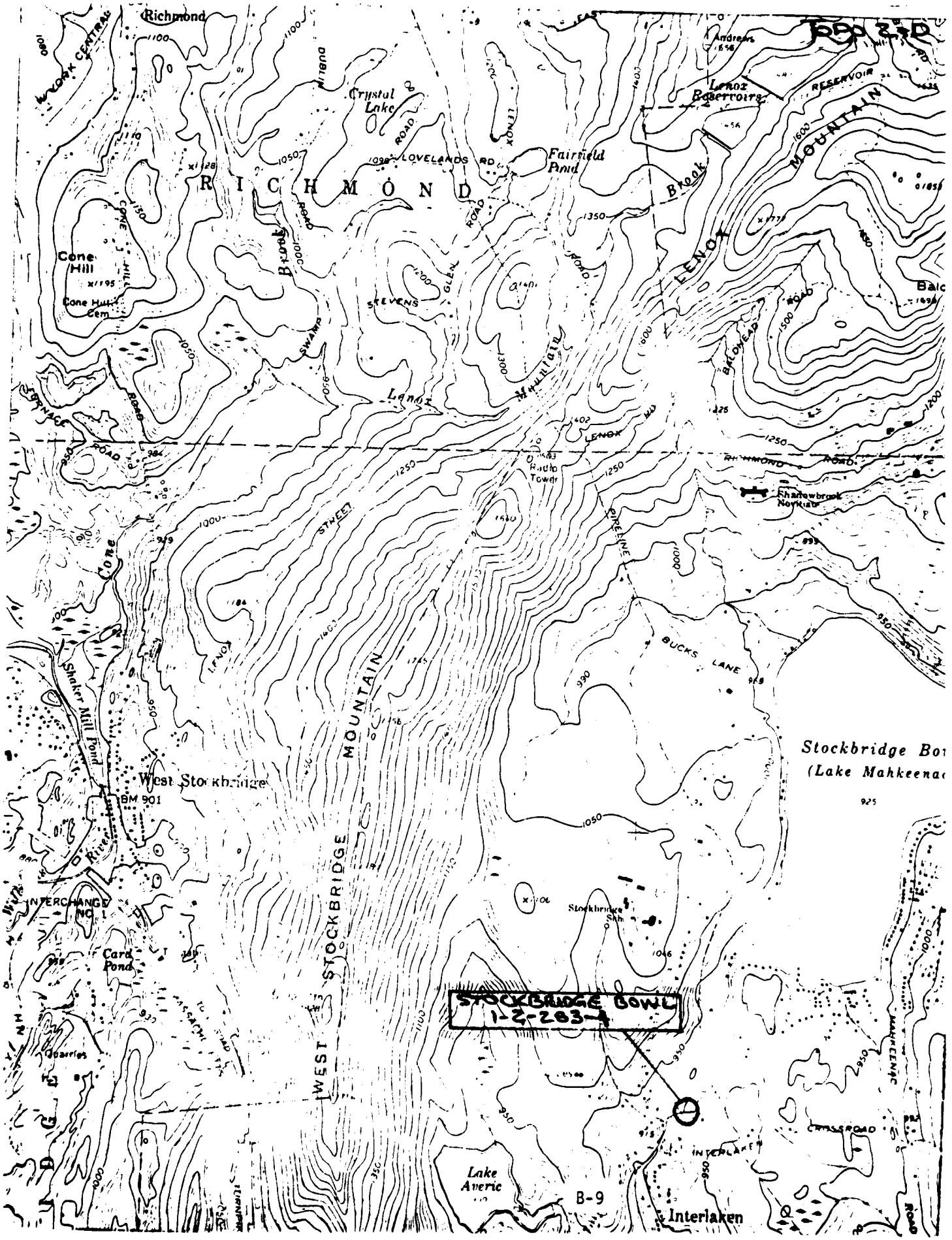
Attach Sketch of dam to this form showing section and plan on 8-1/2" x 11" sheet.

RDJrep

STOCKBRIDGE BOWL
1-2-283-4






Richmond
RICHMOND
Crystal Lake
Fairfield Pond
Lenox Reservoir
Lenox Mountain
Cone Hill
Cone Hill Cem
Stevens Glen
Lenox
Bucks Lane
Shaker Mill Pond
West Stockbridge
BM 901
West Stockbridge Mountain
Stockbridge Bowl
1-2-283-4
Stockbridge Bowl
(Lake Mahkeenac
Interlaken
Lake Averic
B-9

COUNTY OF BERKSHIRE, MASS.

INSPECTION OF DAMS

City or Town of Stockbridge Date October 23, 1969

Name of Dam Stockbridge Bowl Inspector William A. Heaphy

Owner Town of Stockbridge Address Town Hall, Stockbridge, Mass. Tel

Caretaker John Downs Address Interlaken, Mass. Tel 298-3291

Location South end of bowl, near route 183

Type and Dimensions Earth like along canal, concrete at flood gate

12 - 20 feet wide, 12 feet high.

Spillway type and size Concrete masonry [illegible] feet long, [illegible] inch freeboard.

Outlets, type and size Wood gate to 66 inch steel flume outlet.

Flashboards, type and height None

Date Built Condition Good

When last repaired 1969 By whose orders Owner

Nature of Repairs Steel plate welded to upstream face of wooden gate. Deteriorated concrete removed and replaced on spillway.

Purpose of Dam Recreation

Approximate storage of water 372 acres

Approximate area of water shed 10.3 square miles

Possible damage due to failure of dam Serious to property below.

Remarks Area clean about spillway. Water 6 inches below spillway.

Recommendations None

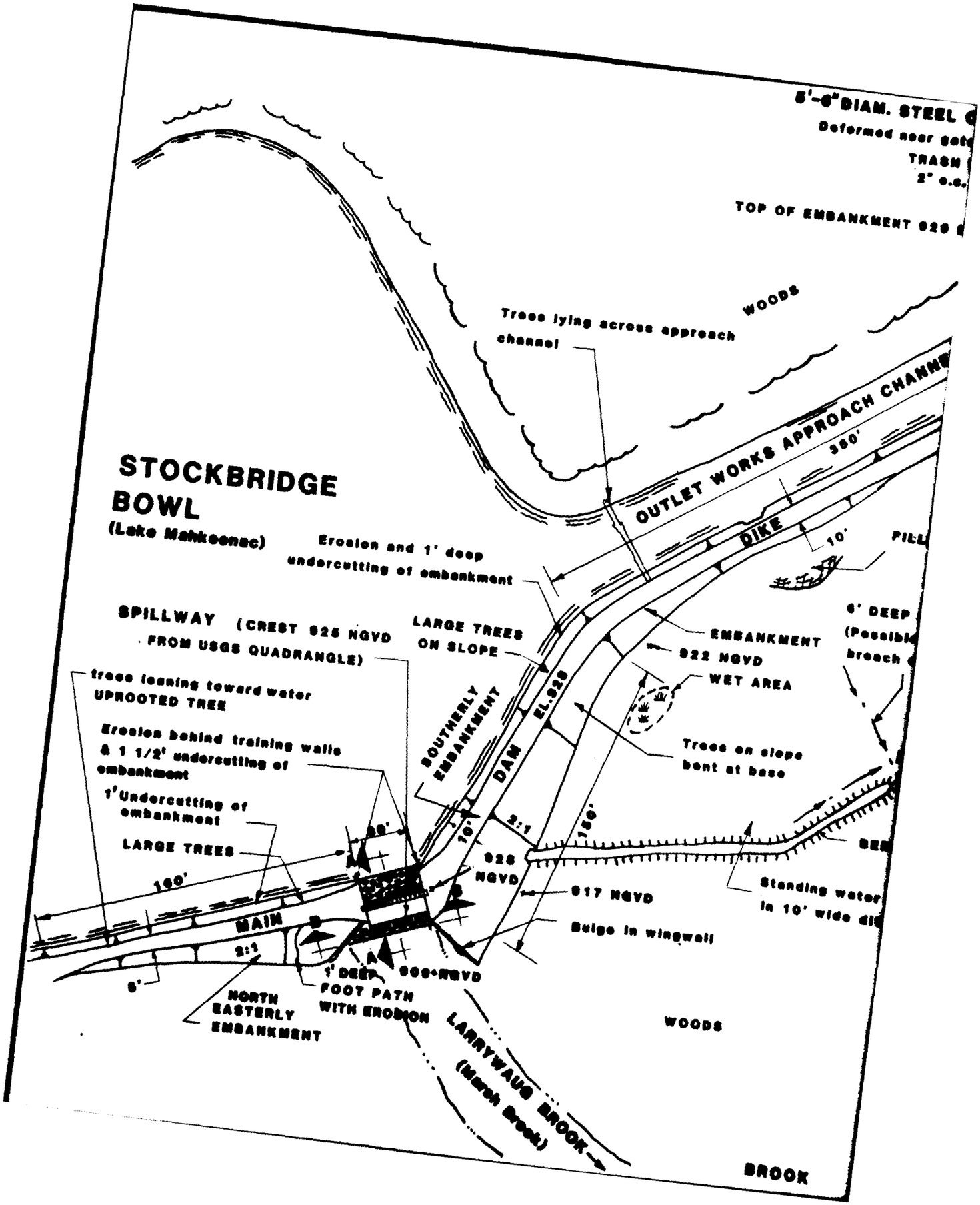
A. SKETCHES COMPILED DURING PHASE I INSPECTION SHOWING GENERAL LAYOUT OF DAM, TYPICAL SECTIONS AND DETAILS OF SIGNIFICANT FEATURES:

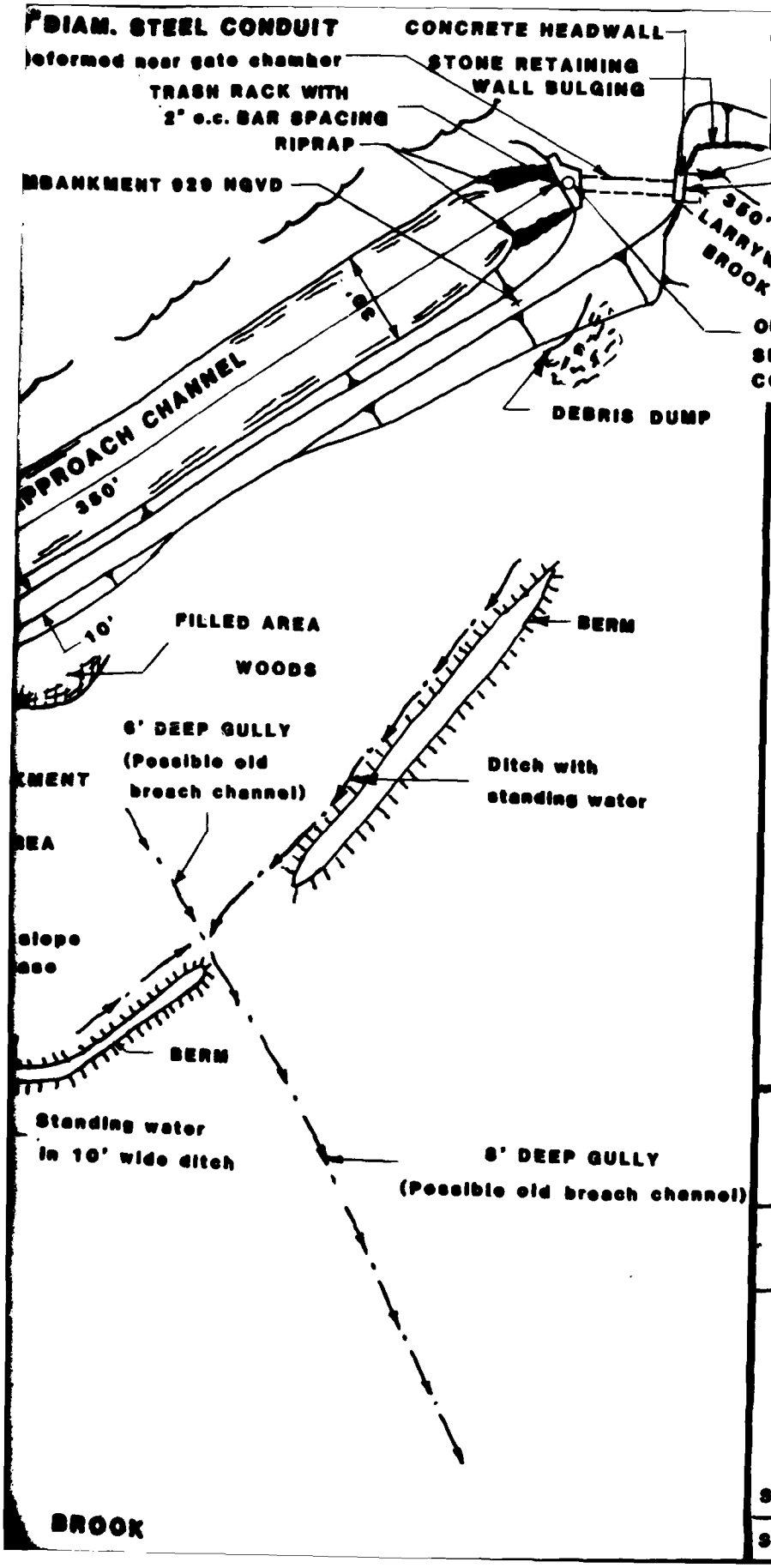
Figure 1. General Plan of Damsite

Figure 2. Typical Sections

B. RECORD PLANS:

Department of Public Works License No. 1160 with 5 sheets of plans.


STOCKBRIDGE
BOWL
(Lake Mahkeenac)
5'-6" DIAM. STEEL
Deformed near
TRASH
2" o.c.
TOP OF EMBANKMENT 928
WOODS
Trees lying across approach channel
OUTLET WORKS APPROACH CHANNE
350'
DIKE
10'
PILL
Erosion and 1' deep undercutting of embankment
SPILLWAY (CREST 925 NGVD FROM USGS QUADRANGLE)
LARGE TREES ON SLOPE
EMBANKMENT
922 NGVD
WET AREA
6' DEEP
(Possibl
breach
trees leaning toward water
UPROOTED TREE
Erosion behind training walls & 1 1/2' undercutting of embankment
SOUTHERLY EMBANKMENT
DAM
EL.928
Trees on slope bent at base
1' Undercutting of embankment
LARGE TREES
50'
10'
2:1
150'
928 NGVD
917 NGVD
Standing water in 10' wide di
190'
MAIN
2:1
Bulge in wingwall
5'
1' DEEP FOOT PATH WITH EROSION
NORTH EASTERLY EMBANKMENT
WOODS
LARRYWAUG BROOK
(Marsh Brook)
BROOK



NOTE Elevation Datum is Based on Elevation of Stockbridge, Bowl as shown on USGS Stockbridge, Mass. Quadrangle

APPENDIX B FIGURE 1

GENERAL PLAN

B-12

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS

ROBERT G. BROWN & ASSOCIATES, INC.
Pittsfield, Massachusetts

NATIONAL PROGRAM FOR
INSPECTION OF NON-FEDERAL DAMS

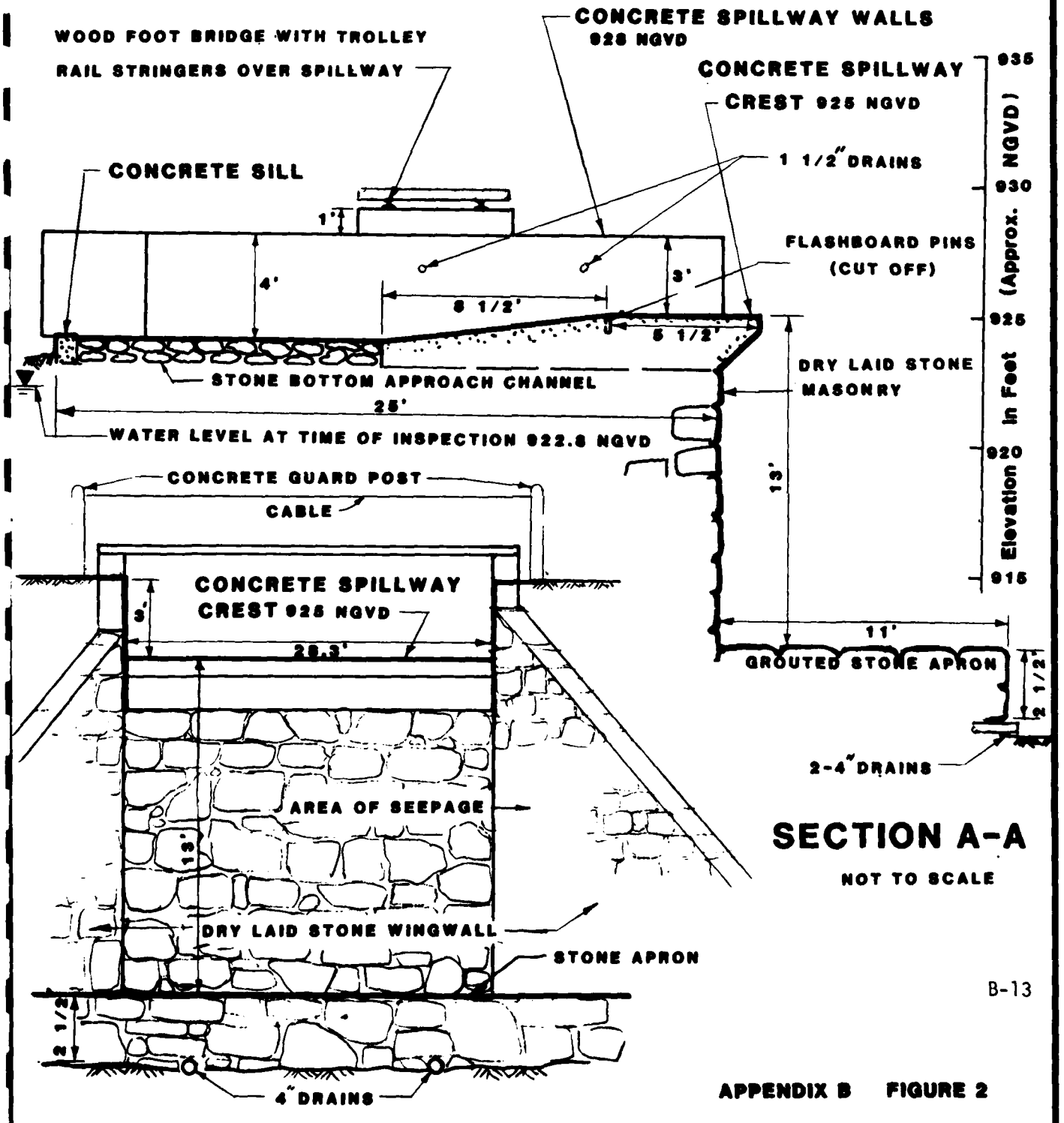
STOCKBRIDGE BOWL DAM

MA 00022
TR- HOUSTONIC RIVER

STOCKBRIDGE MASSACHUSETTS

SCALE: NOT TO SCALE | DATE: FEB 1981

NOTE: Elevation Datum is Based on Elevation of Steckbridge Bowl as shown on USGS Steckbridge,Mass. Quadrangle



SECTION A-A
NOT TO SCALE

SECTION B-B
NOT TO SCALE

B-13

APPENDIX B FIGURE 2

STOCKBRIDGE BOWL DAM

Form WD 64.
1M-12-'28. No. 4178-1.

The Commonwealth of Massachusetts

No. 1160.

Whereas, the Town of Stockbridge, by its Board of Selectmen,

of ----------, in the County of Berkshire-------- and Commonwealth aforesaid, has applied to the Department of Public Works for license to repair the spillway at the Barker dam, so called, to repair the lower dam, to extend the draw off pipe at said lower dam, and to remove the reservoir or upper dam, at Lake Mahkeenac or Stockbridge Bowl, in the town of Stockbridge,----------

and has submitted plans of the same; and whereas due notice of said application, and of the time and place fixed for a hearing thereon, has been given, as required by law, to the ----------

Selectmen---------- of the town--- of Stockbridge----------;

Now, said Department, having heard all parties desiring to be heard, and having fully considered said application, hereby, subject to the approval of the Governor and Council, authorizes and licenses the said

Town of Stockbridge, by its Board of Selectmen,----------

---------- subject to the provisions of the ninety-first chapter of the General Laws, and of all laws which are or may be in force applicable thereto, to repair the spillway at the Barker dam, so called, to repair the lower dam, to extend the draw off pipe at said lower dam, and to remove the reservoir or upper dam, at Lake Mahkeenac or Stockbridge Bowl in the town of Stockbridge, in conformity with the accompanying plan No. 1160.

Said spillway may be repaired by the construction of a reinforced concrete [illegible]filling edge on top of the existing rubble

stone dam, by the paving with stone of the approach to the spillway, and by the construction of concrete side walls 28 feet apart, as shown on said plan. The crest of said spillway shall be established at elevation 100, as indicated upon said plan.

The lower dam may be rebuilt with a new gate and trash rack, as shown on said plan. The water side of said dam may be reinforced with concrete, and the earth fill back of the structure may be extended a distance of approximately 20 feet, as indicated upon said plan.

A waste pipe 5' 6" in diameter and approximately 40 feet long may be installed at said lower dam, as shown upon said plan. The invert of said pipe shall be at elevation 91 as indicated upon said plan.

The reservoir or upper dam may be entirely removed from said lake.

The plan of said work, numbered ----------1 1 6 0,---------- is on file in the office of said Department, and duplicate of said plan accompanies this License, and is to be referred to as a part hereof.

~~The amount of tide water displaced~~ by the work hereby authorized shall be ascertained by said Department, and compensation therefor shall be ~~made by~~ the said

~~heirs, successors~~

and assigns, by paying into the treasury of the Commonwealth

cents for each cubic yard so displaced, being the amount hereby assessed by said Department.

Nothing in this License shall be so construed as to impair the legal rights of any person.

This License shall be void unless the same and the accompanying plan are recorded within one year from the date hereof, in the Registry of Deeds for the

District of the County of Berkshire.

In Witness Whereof, said Department of Public Works have hereunto set their hands this twenty-seventh day of May, in the year nineteen hundred and thirty.

Arthur W. Dyer
Acting Commissioner of Public Works
Richard K. Hall
H. Armando A.

Department of Public Works

THE COMMONWEALTH OF MASSACHUSETTS

This license is approved in consideration of the payment into the treasury of the Commonwealth by the said

of the further sum of

the amount determined by the Governor and Council as a just and equitable charge for rights and privileges hereby granted in land of the Commonwealth.

Approved by the Governor and Council.

Boston, May 27, 1930
William J. Reis
Executive Secretary

Sheet No 1

Total Number of Sheets - 5

Dam for Stockbridge Bowl
Stockbridge Mass.

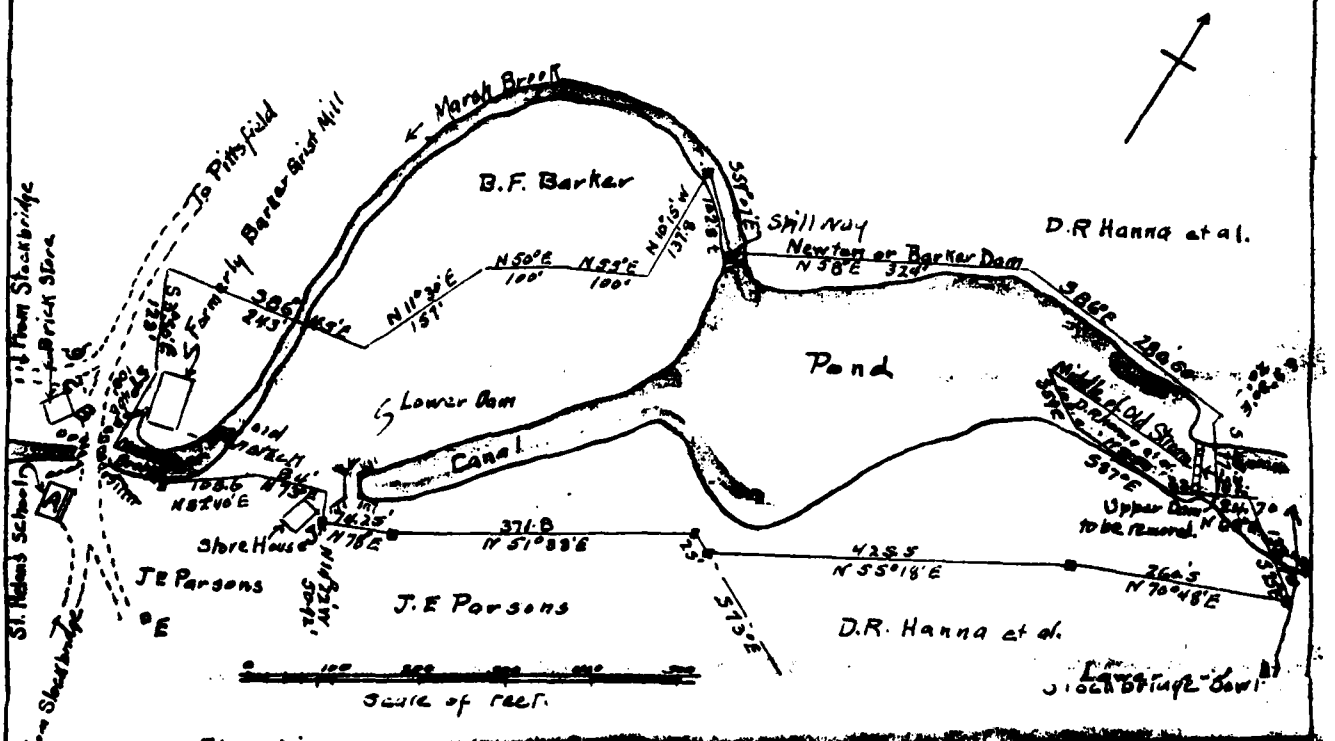
Petitioner :- Town of Stockbridge

Structures to be built:-

Repairing Spillway of Pond.

Repairing Lower Dam or Drawoff.

Extending Drawoff Pipe.



A-	Top of base board (outside) between two main front doors, St. Helens School	84.89'
B-	Top of Marble underpinning below watertable Easterly Corner Brick Store	83.97'
C-	Top of Marble Watertable, close to brick Northerly Corner Brick Store	84.66'
E-	Top of Stone Bound at center	95.82'
J-	" " " " " "	94.69'

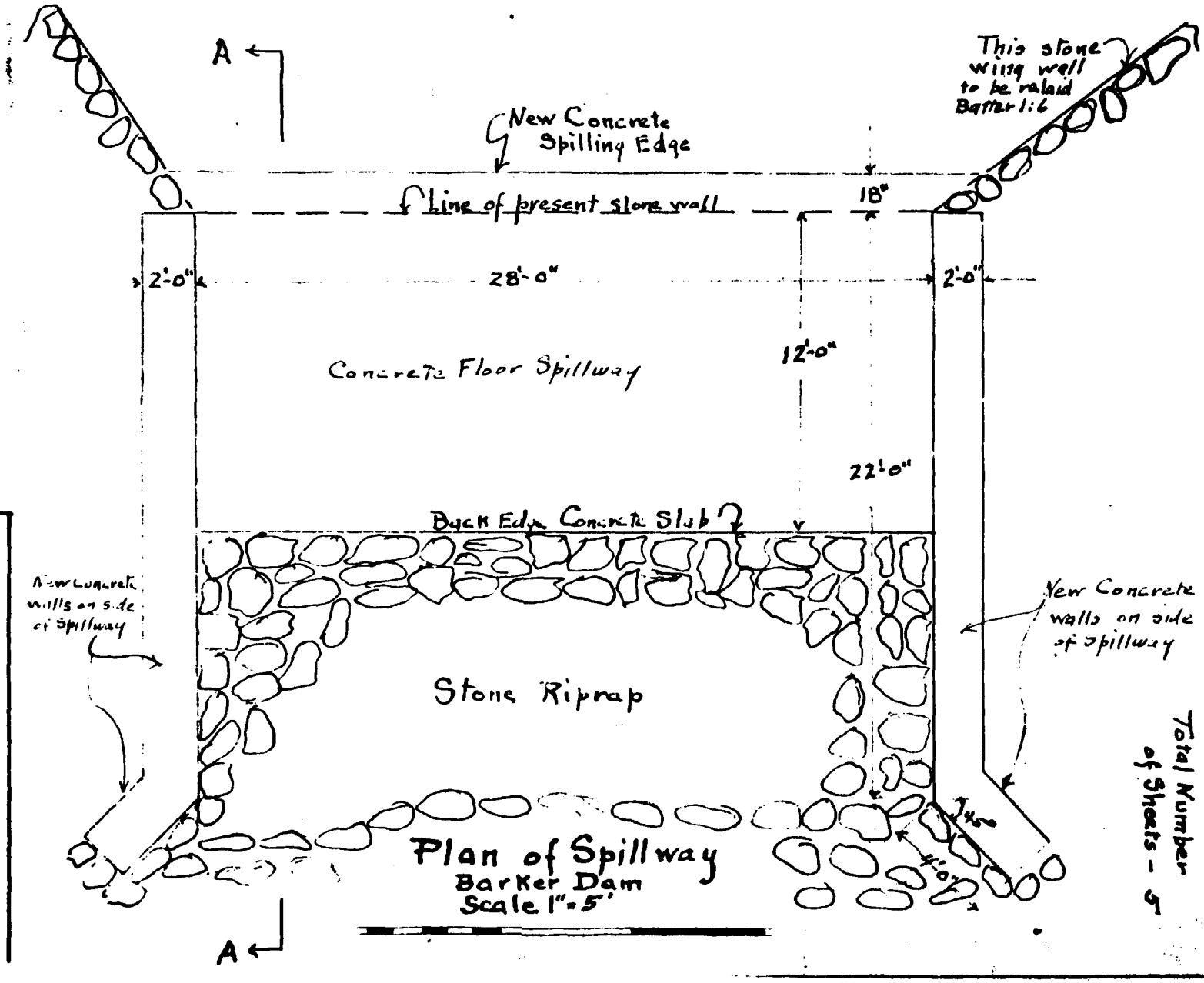
NO. 1160

APPROVED BY DEPARTMENT OF PUBLIC WORKS

MAY 27, 1930

ACTING COMMISSIONER OF PUBLIC WORKS

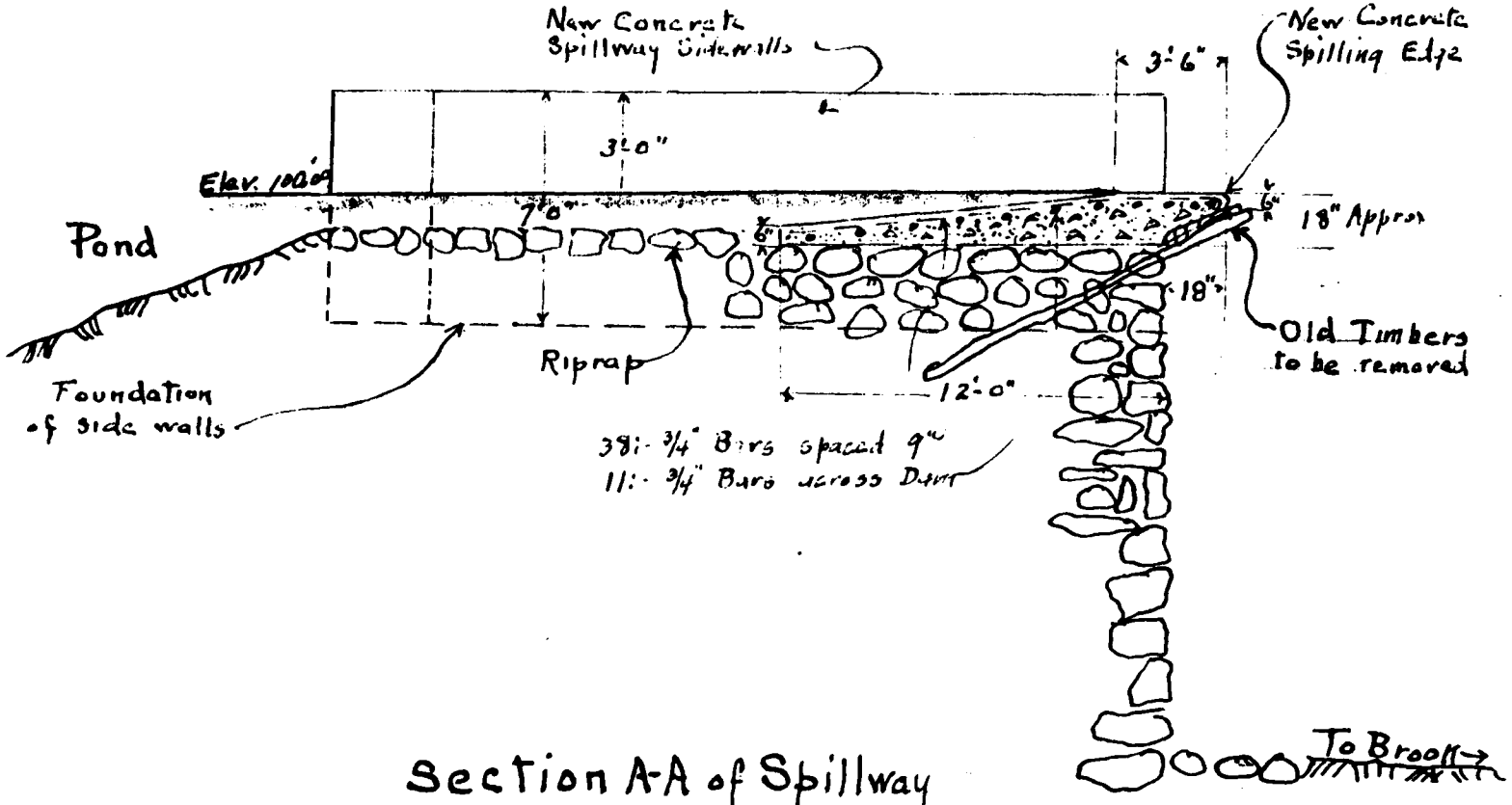
ASSOCIATE COMMISSIONER



B-18

LICENSE PLAN NO. 1160
APPROVED MAY 27, 1930

Sheet No 2
Total Number of Sheets - 5



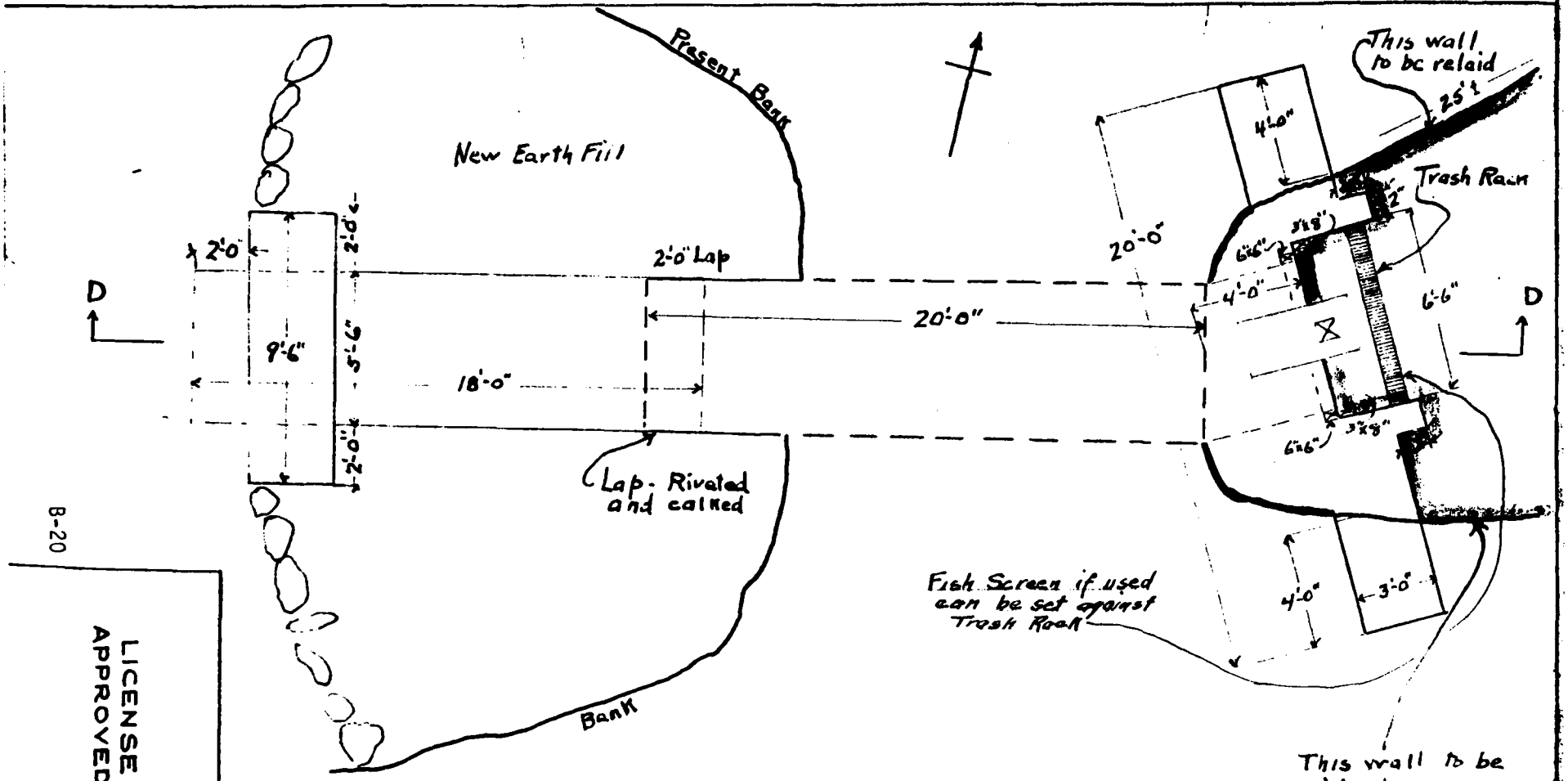
Section A-A of Spillway
Barker Dam
Scale 1"=5'

0 1 2 3 4 5 10 15

LICENSE PLAN NO. 1160
APPROVED MAY 27, 1930

B-19

Sheet No 3
Total number
of Sheets - 5



Plan of Lower Dam

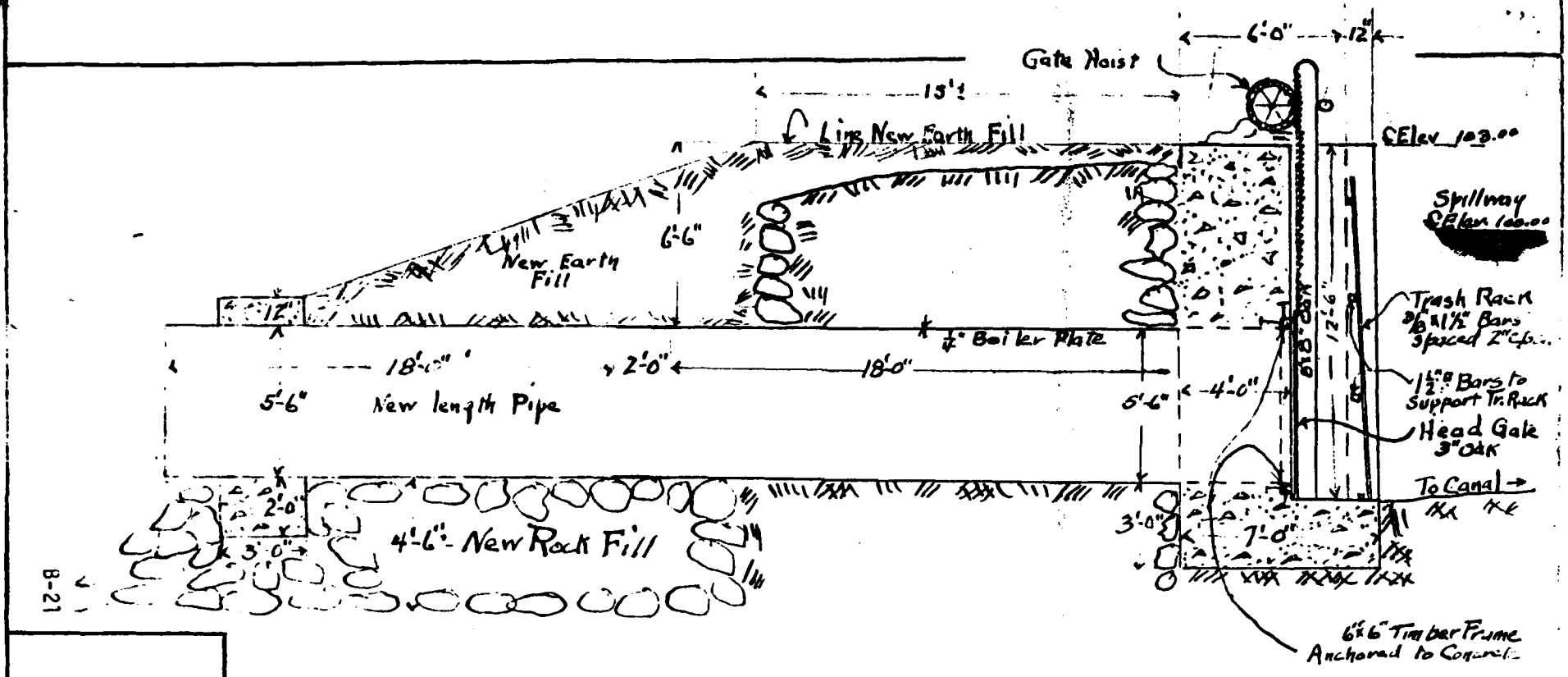
Scale 1" = 5'

0 1 2 3 4 6 10 15

B-20

LICENSE PLAN NO. 1160
APPROVED MAY 27, 1930

Sheet No 4
Total number of Sheets - 5



B-21

Lower Dam Section D-D

Scale 1"=5'

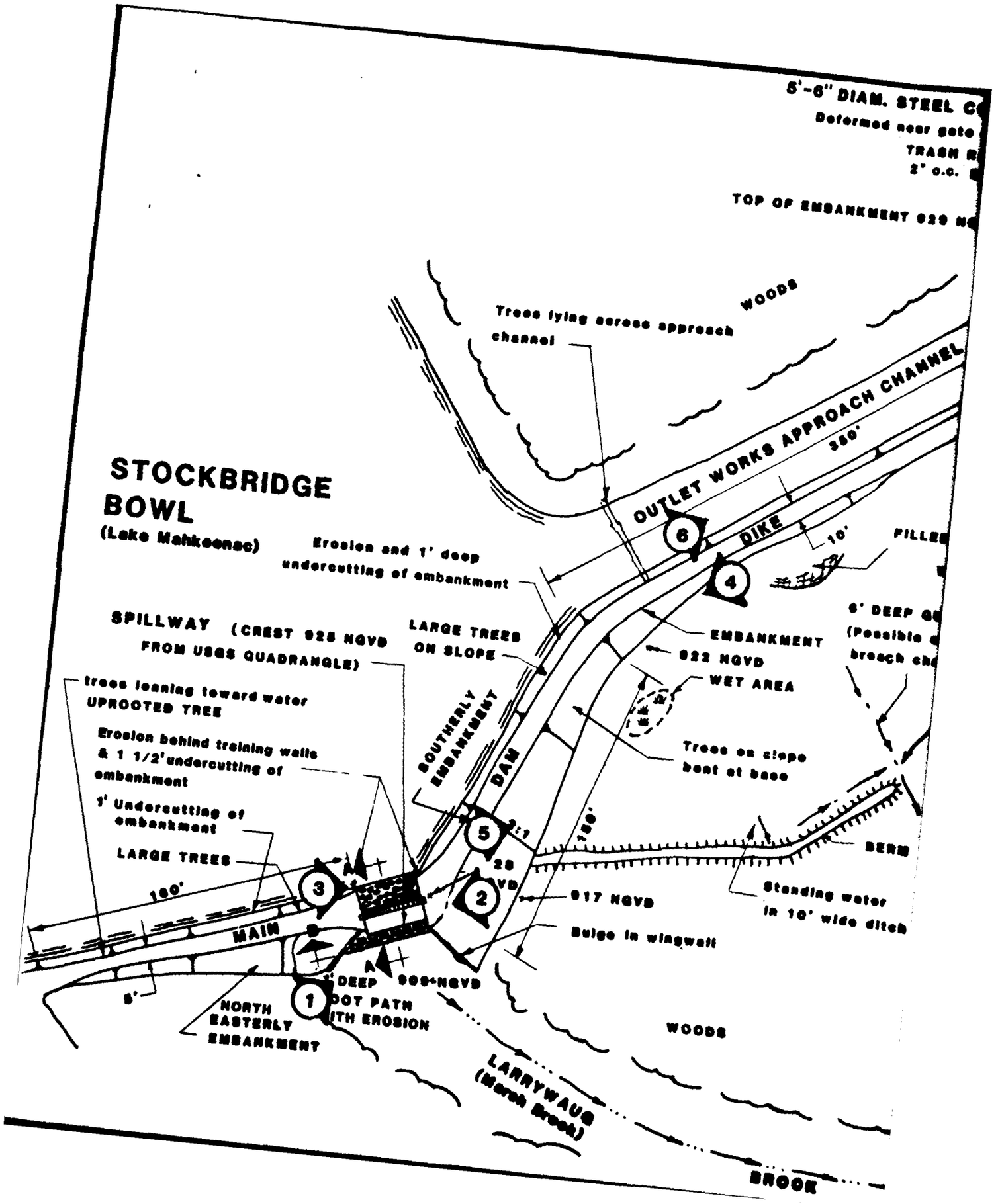
0 1 2 3 4 5 10 15

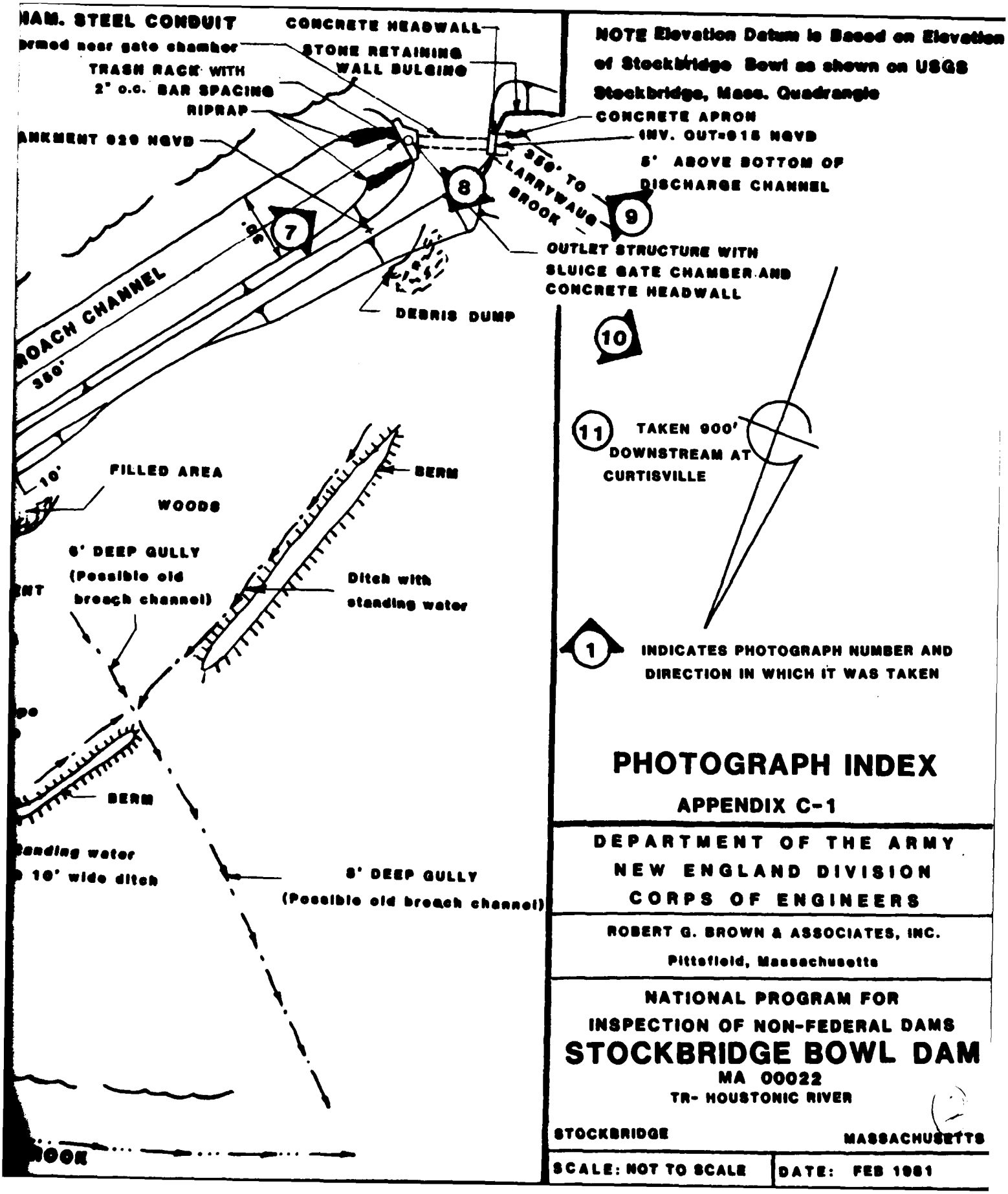
LICENSE PLAN NO. 1160
APPROVED MAY 27, 1930

Sheet No 5
Total number
of Sheets - 5

APPENDIX C

PHOTOGRAPHS


STOCKBRIDGE
BOWL
(Lake Mahkeenac)
5'-6" DIAM. STEEL C
Deformed near gate
TRASH R
2" o.c.
TOP OF EMBANKMENT 928 N
WOODS
Trees lying across approach channel
OUTLET WORKS APPROACH CHANNEL
350'
DIKE
10'
PILLE
Erosion and 1' deep undercutting of embankment
SPILLWAY (CREST 925 NGVD FROM USGS QUADRANGLE)
LARGE TREES ON SLOPE
EMBANKMENT
922 NGVD
WET AREA
6' DEEP G
(Possible
breach ch
trees leaning toward water
UPROOTED TREE
Erosion behind training walls & 1 1/2' undercutting of embankment
1' Undercutting of embankment
SOUTHERLY EMBANKMENT
DAM
2:1
150'
Trees on slope bent at base
BERM
LARGE TREES
100'
MAIN
28
VD
917 NGVD
Standing water in 10' wide ditch
Bulge in wingwall
DEEP
905+NGVD
OOT PATH
ITH EROSION
5'
NORTH EASTERLY EMBANKMENT
WOODS
LARRYWAUG
(Marsh Brook)
BROOK



NOTE Elevation Datum is Based on Elevation of Stockbridge Bowl as shown on USGS Stockbridge, Mass. Quadrangle

PHOTOGRAPH INDEX

APPENDIX C-1

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS

ROBERT G. BROWN & ASSOCIATES, INC.
Pittsfield, Massachusetts

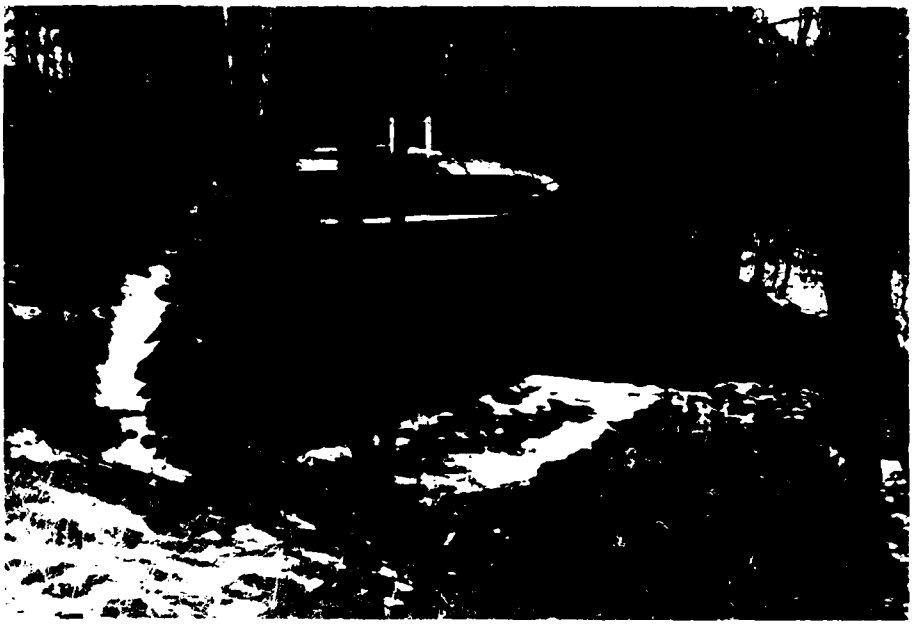
NATIONAL PROGRAM FOR
INSPECTION OF NON-FEDERAL DAMS

STOCKBRIDGE BOWL DAM

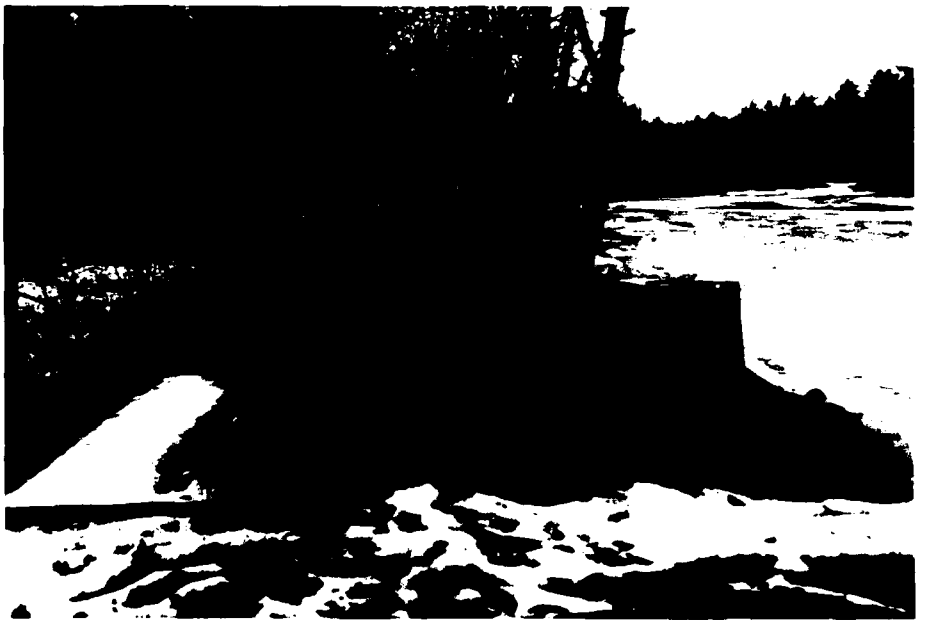
MA 00022
TR- HOUSTONIC RIVER

STOCKBRIDGE MASSACHUSETTS

SCALE: NOT TO SCALE | DATE: FEB 1981



Photograph 1 - View of downstream face of spillway showing concrete crest, footbridge, wingwalls, and discharge apron. Note trees and brush adjacent to wingwalls.



Photograph 2 - Crest of northeasterly embankment. Note leaning trees on embankment slopes and footpath on crest.

Photograph 3 - Crest and upstream slope of southerly embankment. Note trees on slope. Also note erosion adjacent to spillway wall and footpath on crest. Approach channel for spillway is in foreground.

Photograph 4 - Crest of dike at point where dike joins southerly embankment.

Photograph 5

Toe area of southerly embankment and dike. Note standing water in ditch. Ditch runs roughly parallel to the toe of the dike and may be old sluiceway.

Photograph 6 - View of outlet works approach channel showing dike on the right. Note erosion and trees on upstream slope of dike.

Photograph 7 - Upstream end of outlet works showing trash rack, concrete gate chamber and sluice-gate operator. Note trees, erosion, slumped riprap and accumulated debris adjacent to outlet works.

Photograph 8 - View of downstream slope of dike near southwest end showing tree growth and debris dump. Note standing water in ditch at the toe of dike.

Photograph 9 - Downstream end 5'-6" outlet conduit showing concrete endwall and stone masonry retaining wall.

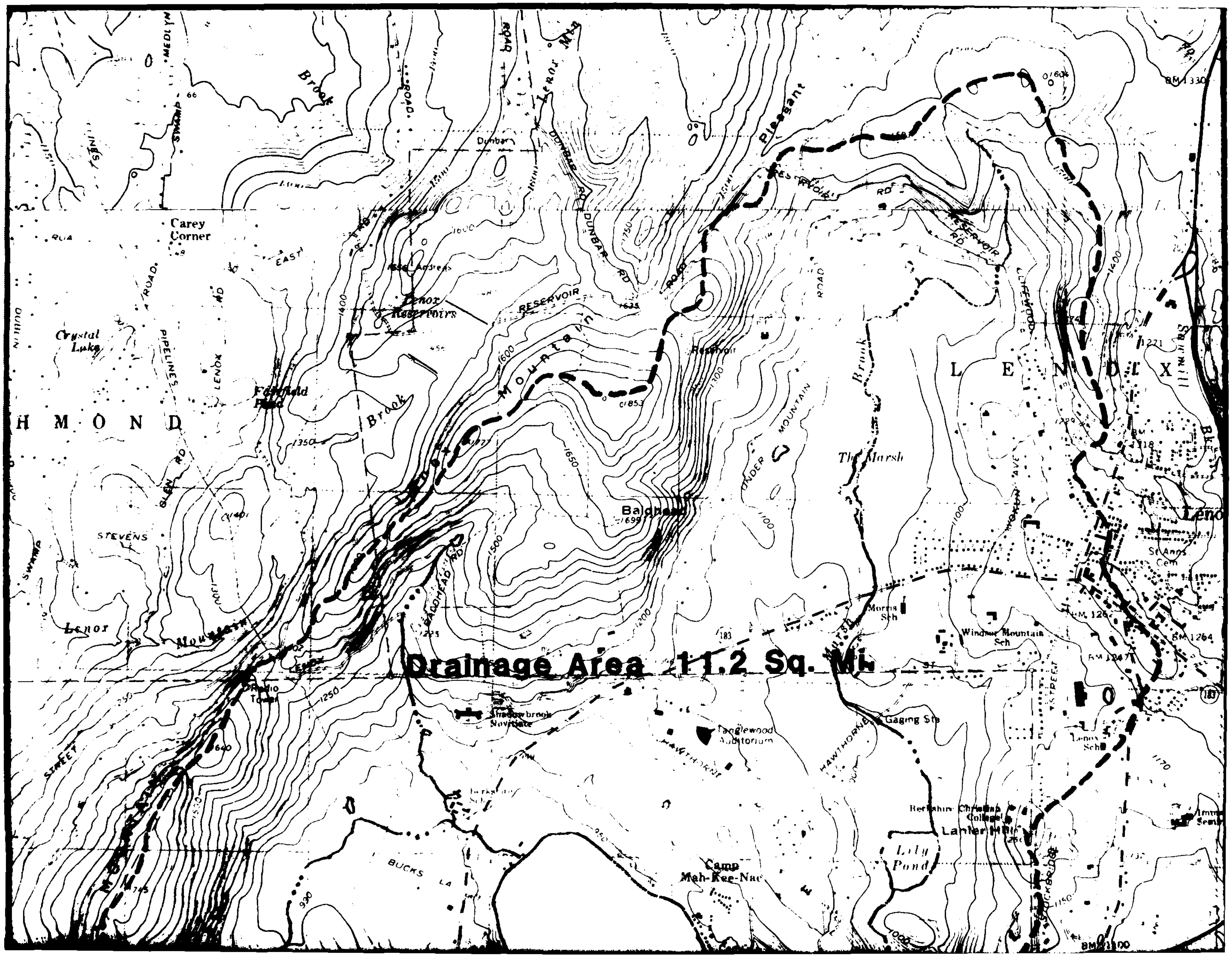
Photograph 10

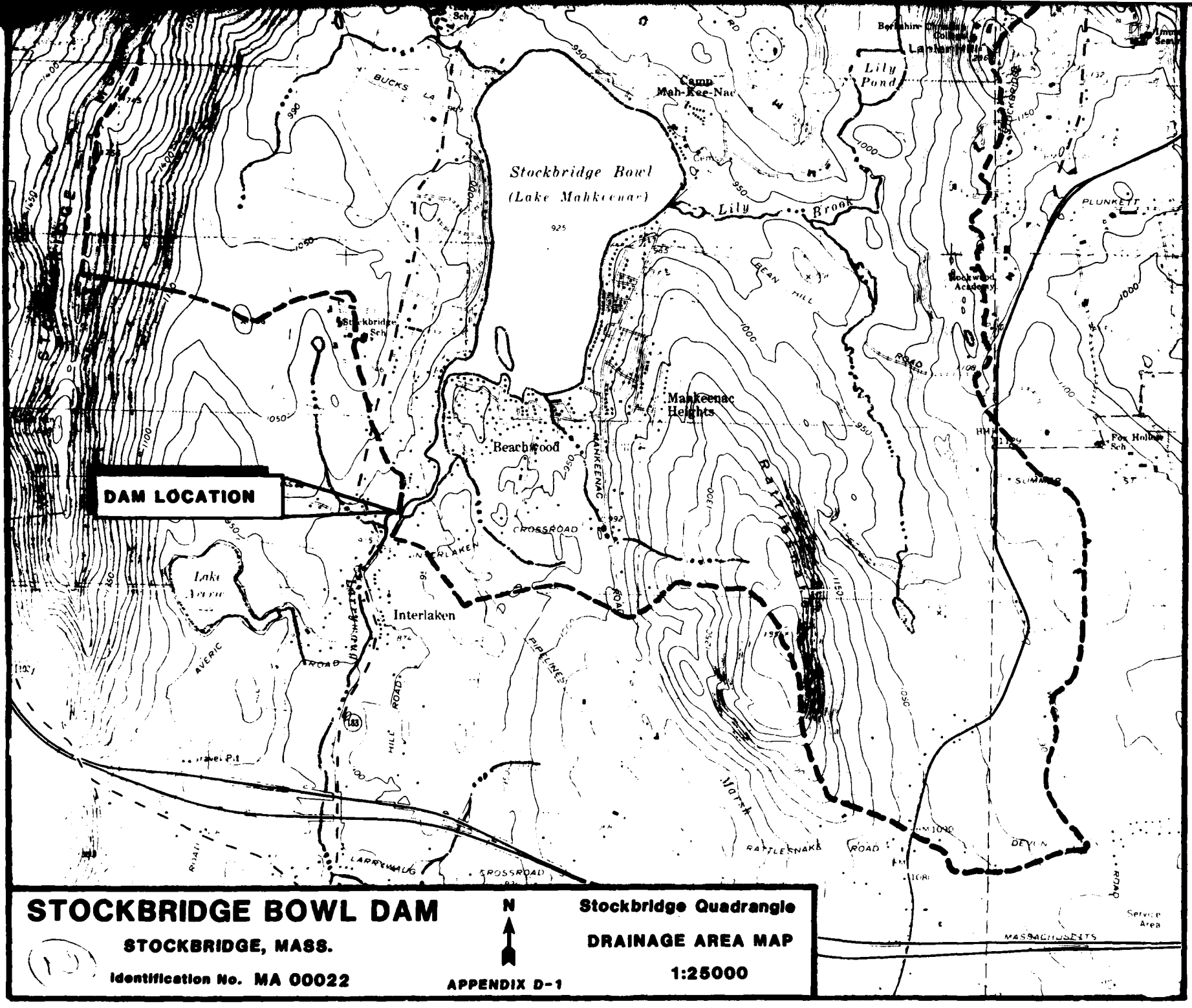
Downstream channel at location where discharge channel for outlet works joins Larrywaug Brook.

Photograph 11 - Stone arch bridge under reconstruction in Curtisville Historic District.

APPENDIX D

HYDRAULIC AND HYDROLOGIC COMPUTATIONS


Drainage Area 11.2 Sq. Mi.
Carey Corner
Crystal Lake
Lenox Reservoirs
Fairfield Pond
Dunbar
Pleasant
Lenox Mtn
Baldhead
Reservoir
The Marsh
Brook
Lenox Mountain
Radio Tower
Shadowbrook Novitiate
Tanglewood Auditorium
Gaging Sta
Morris Sch
Windsor Mountain Sch
Lenox Sch
Berkshire Christian College
Lanier Mill
Lily Pond
Camp Mah-Kee-Nac
BUCKS LA
HAWTHORNE
UNDER MOUNTAIN ROAD
RESERVOIR RD
DUNBAR RD
BALDHEAD RD
PIPELINES
STEVENS
St Anns Cem
L E N O X
H M O N D



STOCKBRIDGE BOWL DAM

STOCKBRIDGE, MASS.

Identification No. MA 00022

Stockbridge Quadrangle

DRAINAGE AREA MAP

1:25000

APPENDIX D-1

Robert G. Brown & Associates, Inc.
Berkshire Common - Third Floor North
PITTSFIELD, MASSACHUSETTS 01201
(413) 499-1560

JOB MA 12 Stockbridge Bowl Dam
SHEET NO. 1 OF 11
CALCULATED BY JFC DATE 2/4/21
CHECKED BY [illegible] DATE 2/[illegible]
SCALE

Drainage Area - 11.2 Sq.M. by planimeter

Surface Area of Lake - 372 Ac.

S.A/DA. = 372/11.2 × 640 = 0.052

Size - Intermediate - because of storage > 1000 Ac-ft
Hazard - High - because of potential for loss of more than a few lives in village of Interlaken.
Test Flood - PMF

Calculate PMF using "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Inspections" Mar. 1990

For Rolling Terrain, 11.2 S.M.

PMF = 1600 CSM × 11.2 S.M. = 17,920 c.f.s.

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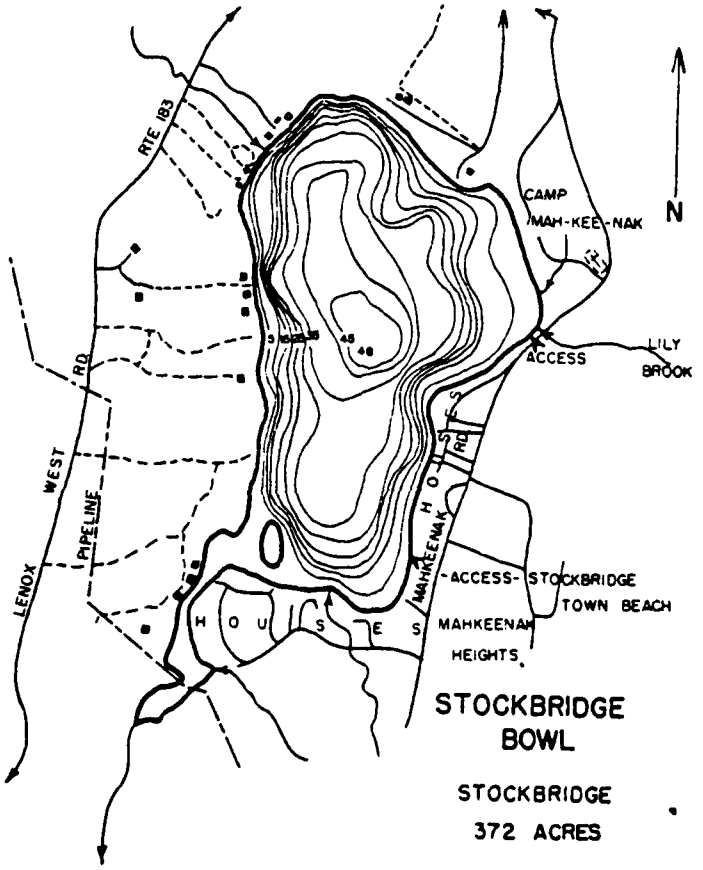
JOB MA 19 Stockbridge Bowl Dam
SHEET NO 1A OF 11
CALCULATED BY TEC DATE 2/4/91
CHECKED BY _____ DATE _____
SCALE _____



Bathymetric Data From Inventory of the Ponds, Lakes and Reservoirs of Massachusetts, Berkshire & Franklin Cos. Univ. of Mass. Water Resources Research Center Pub. No. V-2 by J.A. McCann & Leo M. Daley.

Mean Depth = 27'
Max Depth = 53'

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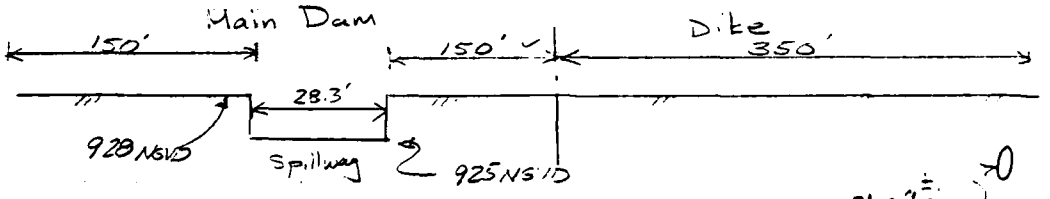
(413) 499-1560

JOB MA 19 Stockbridge Bowl Dam
SHEET NO 2 OF 11
CALCULATED BY JFC DATE 2/4/21
CHECKED BY [illegible] DATE 2/[illegible]
SCALE

Generalized profile used in discharge rating



Note - gate for 5'-6"± outlet is in poor condition. Gate presently not seated. s/o's observed. It is possible that trash rack upstream of gate could be plugged with debris and restrict flow through gate. Gate not opened more than 1/2 est. flow 27 cfs at time of insp.

ELEV	FLOW THRU SPILLWAY C	L	H	Q	FLOW OVER DAM + DIKE C	L	H	Q	Q_D	Q_TOTAL
925	3.2	23.3	0	0	-	-	-	-	27	27
927			2	256	-	-	-	-		283
928			3	470	2.8	650	0	0		497
929			4	724			1	320		2571
930			5	1012			2	5147		6186
932			7	1677			4	14560		16264
932.5			7.5	1860			4.5	17374		19261
933.2	3.2	28.3	6.6	1535						

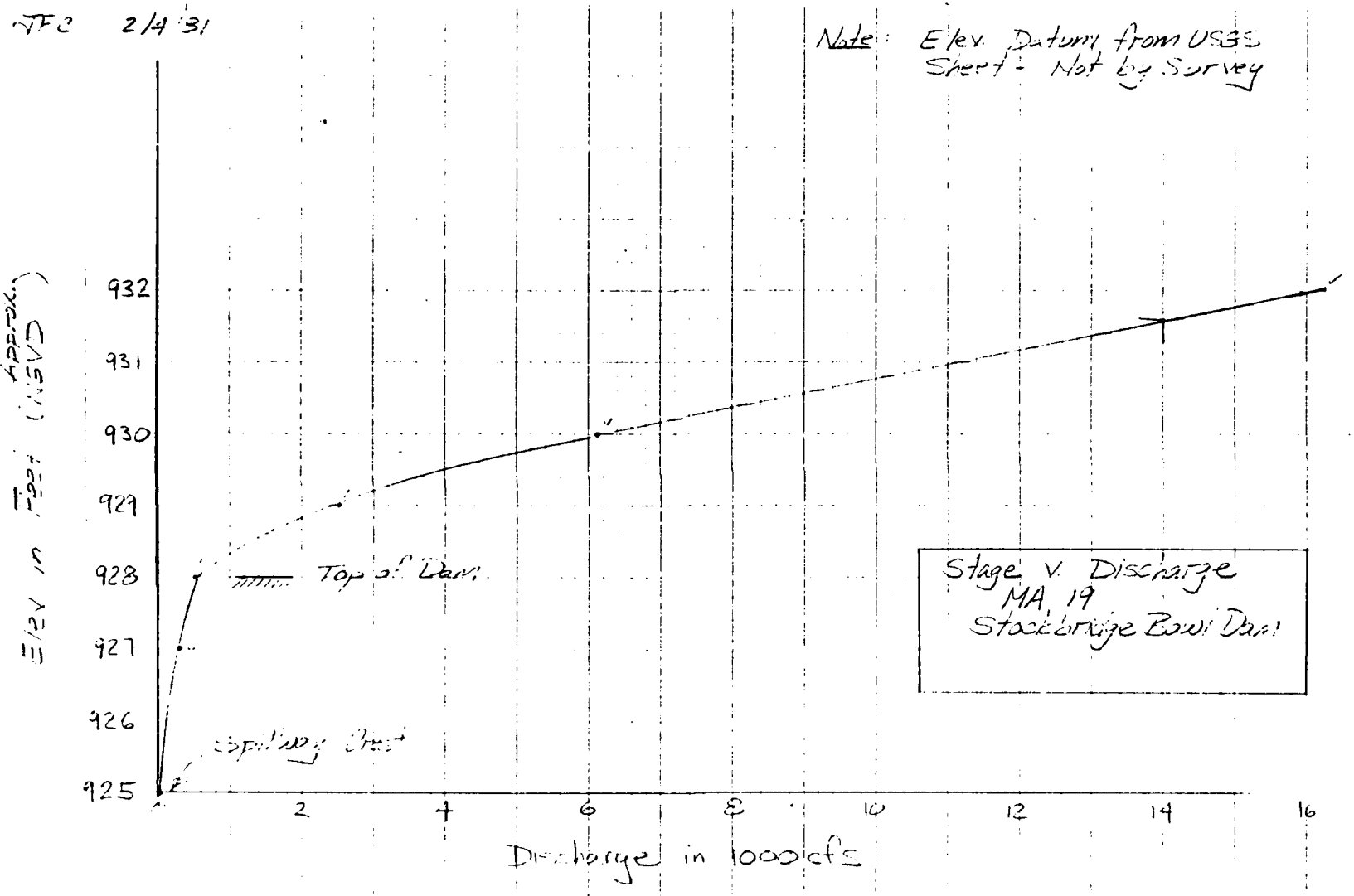
$Q_D = C_d \times \frac{\pi 5.5^2}{4} \sqrt{64.4 \times 10}$
$= 360$ cfs

Stage vs. Discharge Data

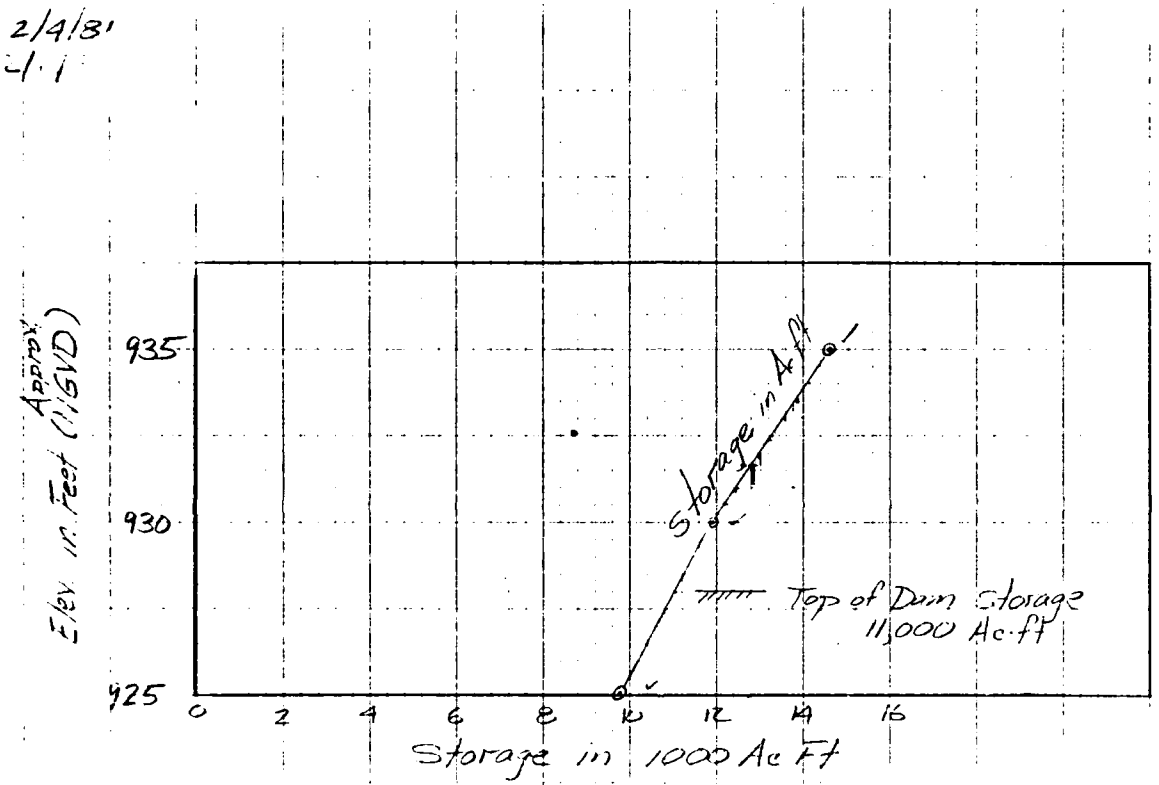
Elev.	Surface Area (Acres)	Δ Storage (Ac-Ft)	Σ Storage (Ac-Ft)
925	372		9860
930	450	2055	11915
935	550	2500	14415

Normal Storage
372 Ac + 25.5 Ac-ft =
9860 Ac-ft
Ref. Pub. No. 10-12
includes vol of natural pond

Stage Storage Data


JFC 2/4/31
Note: Elev. Datum from USGS Sheet - Not by Survey
Elev in Feet (USGS approx.)
932
931
930
929
928
927
926
925
Top of Dam
Spillway Crest
2
4
6
8
10
12
14
16
Discharge in 1000 cfs
Stage V. Discharge
MA. 19
Stockbridge Bowl Dam

JFL 2/4/81
MC 4-1



Stage V. Storage
MA 19
Stockbridge Bowl Dam

9-0

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(413) 499-1560

JOB MA19 Stockbridge Bowl Dam
SHEET NO. 5 OF 11
CALCULATED BY JFC DATE 2/4/91
CHECKED BY JMC DATE 2/11/91
SCALE Surcharge Estimate

PMF Test Flood

Q_{P_1} → 17920 cfs ✓ → 932.3 NGVD ✓ → 13200 Ac-ft ✓

Storage @ 925 = 9360 Ac-ft ✓

Δ Storage = 3340 Ac-ft ✓

$STOR_1 = 3340 \text{ Ac-ft} \times \frac{1}{11.2 \text{ sq mi}} \times \frac{\text{sq mi}}{53.3 \text{ Ac-ft}} = 5.60"$ ✓

$Q_{P_2} = Q_{P_1} \times \left(1 - \frac{STOR_1}{19}\right)$ ✓

$Q_{P_2} = 17920 \times \left(1 - \frac{5.60}{19}\right) = 12638 \text{ cfs}$ ✓ → 931.3 NGVD → ✓

12,500 Ac ft ✓

Δ Storage = 12,500 − 9860 = 2640 Ac-ft ✓

$STOR_2 = 2640 \times \frac{1}{11.2} \times \frac{1}{53.3} = 4.42"$ ✓

$STOR_{AVE} = \frac{STOR_1 + STOR_2}{2} = \frac{5.60 + 4.42}{2} = 5.01"$ ✓

Δ storage = 5.01" × 11.2 sq mi × 53.3 Ac-ft / sq mi = 2990 Ac-ft →

(9860 Ac-ft + 2990 Ac-ft) → 12850 Ac-ft → 931.6 NGVD →

14000 cfs ✓

Convergence OK first iteration

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(413) 499-1560

JOB MA 19 Stockbridge Bowl Dam
SHEET NO. 6 OF 11
CALCULATED BY JFC DATE 2/4/81
CHECKED BY J... DATE ...
SCALE

Summary

Test Flood	PMF
Test Flood Inflow	17,920 cfs
Routed Outflow	14,000 cfs
Total Storage at Flood Elev.	12,850 Ac-ft
Surcharge Storage at Flood Elev.	2,990 Ac-ft (above spillway crest)
Test Flood Elev.	931.6 NGVD
Top of Dam Elev	928.0 NGVD
Depth of Overtopping	3.6'
Spillway Capacity at Test Flood Elev.	1535 cfs @ 6.6' Head
Spillway Capacity at Top of Dam	470 cfs
% of Routed Test Flood Outflow	3.4%

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(413) 499-1560

JOB MA 12 Stonebridge Road Dam
SHEET NO 26 OF
CALCULATED BY JFB DATE 5/13/2
CHECKED BY DATE
SCALE Spillway Elevation

1/2 PMF TEST FLOOD

$Q_p \rightarrow \frac{1}{2}(17920\ cfs) = 8960\ cfs \rightarrow 930.6\ NGVD \rightarrow 2.2'$ Surcharge

Storage @ 925 = 9850 Ac-ft

Δ Storage = 2340 Ac-ft

$STOR_1 = 2340\ Ac\text{-}ft \times \frac{1}{11.2\ Sq.M.} \times \frac{Sq.M.}{53.3\ Ac} = 3.92"$

$Q_{\frac{1}{2}} = 8960\left(1 - \frac{3.92}{13/2}\right) = 5263\ cfs \rightarrow 929.3\ NGVD \rightarrow 11,900\ Ac\text{-}ft$

Δ Storage = 11,900 - 9850 = 2040 Ac-ft

$STOR_2 = 2040 \times \frac{1}{11.2} \times \frac{1}{53.3} = 3.42"$

$STOR_{AVE} = \frac{STOR_1 + STOR_2}{2} = \frac{(3.92 + 3.42)}{2} = 3.67"$

Δ storage = $3.67" \times 11.2\ Sq.M. \times \frac{53.3\ Ac}{Sq.M.} = 2191\ Ac\text{-}ft$

$(9850\ Ac\text{-}ft + 2191\ Ac\text{-}ft) \rightarrow 12051\ Ac\text{-}ft \rightarrow 930.1\ NGVD \rightarrow$ 6800 cfs

Summary:

1/2 PMF - 8960 cfs

Routed Outflow - 6800 cfs

Total Storage at 1/2 PMF El. - 12050 Ac-ft @ 930.1 NGVD

Depth of Overtop (930.1 - 928.0) = 2.1 ft

Spillway (Q.2) Floor Elev. = 1040 cfs @ 5.1' head

Spillway Cap. @ Top of Dam = 4700 cfs

1/2 PMF Routed Outflow = 6800 cfs

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JOB MA : Stockbridge Bowl Dam
SHEET NO 7 OF
CALCULATED BY JFC DATE 2/4/91
CHECKED BY dr DATE
SCALE

Breach Analysis

Assume Breach width W_b = 40% length of main dam at mid-ht

$W_b = 0.4 \times 220' = 88'$

Assume breach occurs with water at top of dam.

$Y_o = 18.5'$

$$Q_p = 8/27\ W_b \sqrt{g}\ y_o^{3/2}$$

$$Q_p = 8/27\,(88)(32.2)^{1/2}(18.5)^{3/2} = 11,773 \text{ cfs}$$

Add Spillway flow from unbreached portion.

$Q = 3.2\,(28.3)(3)^{3/2} = 470$ cfs

Total Breach Q = 11773 + 470 = 12243 cfs
Say 12,250 cfs

Note

S = Vol. which could drain through breach
- from bathymetric map it is estimated that lake could drain about 3' max. below normal pool. (emb. could erode)

$$S \cong (4' \times 372\,Ac) + (3' \times 372\,Ac) = 2604 \text{ Ac-ft}$$
(below norm pool; surcharge)

Once area behind dam drains, flow from lake would be controlled by narrow channel in area of gas line Crossing

$Q = CLH^{3/2} = (3.0)(125)(7)^{3/2} = 6934$ cfs

This would be the rate at which lake would drain after initial dam breach. Could be more if channel control erode.

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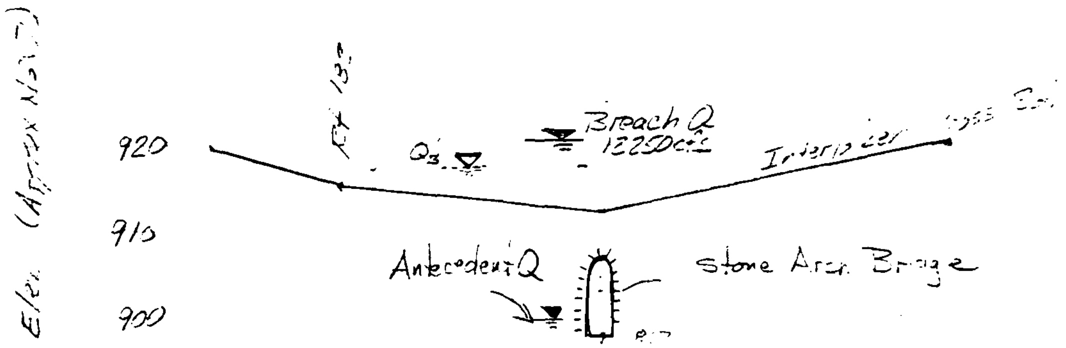
JOB MA 1? Stockbridge Bowl Dam
SHEET NO 8 OF 11
CALCULATED BY JFC DATE 2/4/81
CHECKED BY [illegible] DATE [illegible]
SCALE

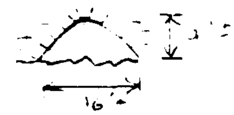
Crossing at Interlaken Rd 600' Downstream



Cross Section - Looking DS

	Flow Thru Arch			Flow Over Rd				
Elev.	h	hw/D	Q	C	L	H	Q	Q TOTAL cfs
912	15'	1.7	1700	2.9	100	0'	0	1700
915	18'	2'	2000	"	125	3'	1334	3334
918	21	2.3	2200	"	125	6	5327	7527
920	23'	2.6	2400	"	150	7'	8056	10456

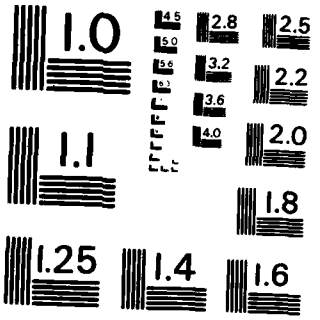
Arch



Note: Flooding about 7' over road assuming road is not washed out. 2 structures at this location - old bridge [illegible] and brick [illegible] [illegible] - [illegible] [illegible] Bldg. Bldgs are [illegible] to stream banks.

AD-A145 327 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS STOCKBRIDGE BOWL DAM (..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV APR 81 2/2

UNCLASSIFIED F/G 13/13 NI



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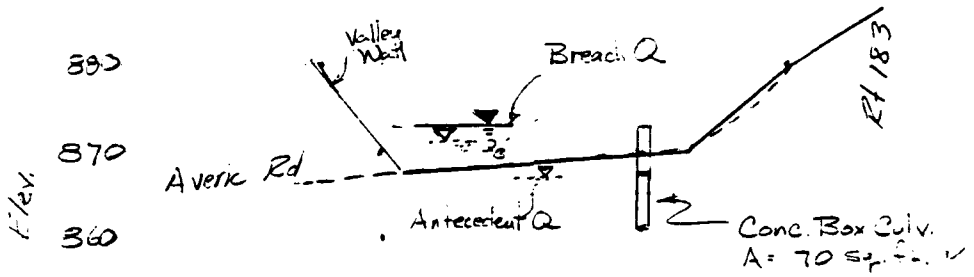
(413) 499-1560

JOB MA 12 Stockbridge Bowl Dam
SHEET NO 9 OF 11
CALCULATED BY JFC DATE 2/4/83
CHECKED BY [illegible] DATE 2/[illegible]/83
SCALE

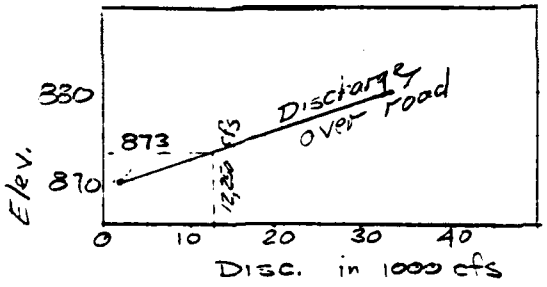
Crossing Averic Road at Interlaken Village - 2500' downstream of Dam



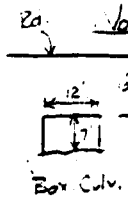
Cross Section Looking U/S

Using $Q = 3.0 L H^{3/2}$ - over road weir flow
neglect box culv. flow during breach
for box culv, $H_w/D = 1.3$
$Q_{cap} = 58 cfs/ft \times 12 = 700 cfs$

Elev.	C	L	H	Q
870	3.0	250	2	2121
880	3.0	350	10	33203



Q_p = 12,250 cfs - breach 2'



Note Brook crosses Rt 183 in conc. box culv. 1300' d.s. of dam. Road would probably wash out here since culv. cap. about 1400 cfs - 1 structure 15' above channel

3 structures - up to 5' flooding possible undermine of foundations also fire house 600' u.s. of this section. -
Antecedent flows would probably cause no flooding of structures

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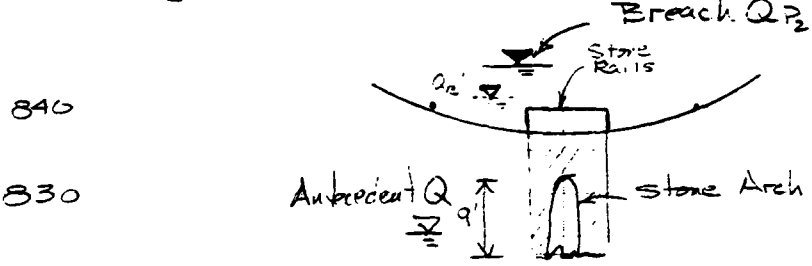
JOB MA 19 Stockbridge Bowl Dam
SHEET NO. 10 OF 11
CALCULATED BY JFC DATE 2/9/21
CHECKED BY [illegible] DATE [illegible]
SCALE

Rt 183 Crossing - 7000' downstream



Cross Section - Looking u.s.

Note - Swamp storage u.s. of Turnpike provides some attenuation - est. 40 Acres
Approx max. storage = 40 Ac x 10' = 400 Ac ft
(Chance of shallow flooding 2 houses on 183 North of Turnpike)

$Q_{P_2} = Q_{P_1}(1 - V_{ave}/S) = 12,250\left(1 - \frac{400}{2500}\right) = 10,368$ cfs

	Flow Thru Arch			Flow over Rd				
Elev.	h	h/D	Q	C	L	H	Q	Q_{tot}
837	14'	1.6'	2000	3.0	80'	0'		2000
840	17	1.9'	2500	"	"	3	1247	3747
845			"	"	"	8	5430	9607

+ flow over Rd
$Q = (3.0)(50)(5)^{1.5}$

Not - 1 house just downstream of this bridge Flooding up to 5'

Below this point Larrywaug brook enters Housatonic River on the north side of Rt. 102. A couple of structures in Rt. 102 area could be flooded.

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(413) 499-1560

JOB MA 19 Stockbridge Bowl Dam
SHEET NO 11 OF 11
CALCULATED BY JFC DATE 2/4/2
CHECKED BY DATE
SCALE

Conclude Regarding Downstream Hazard -

1. The first damage center would be the Historic District at Curtisville - Two structures would be subject to flooding and impact damage. Water would pass over the road at a depth of about 7 feet assuming road is not washed out. Old stone arch bridge at this location is presently being reconstructed.

2. Flooding of 3 or 4 additional structures (up to 5' flood depth) would be likely in the Village of Interlaken about 2500' Downstream. This would include the firehouse which is located on the bank of the brook, The foundation for this structure would be subject to impact and undermine.

3. A swamp on the north side of the Mass Turnpike would provide some attenuation of breach flow. Flooding up to 5' of a house 9000' downstream would be likely. This is where Rt 133 Crosses over Larrywaug Brook (1962 State Aid Rd.)

4. The breach flow would enter the floodplain of the Housatonic River at Route 102 about 7000' downstream of the damsite. 1 or 2 additional structures could be flooded 2-5 feet deep in the Rt 102 area.

Because of the potential for large amount of property damage and potential for loss of more than a few lives - Structure is judged to be High Hazard

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS